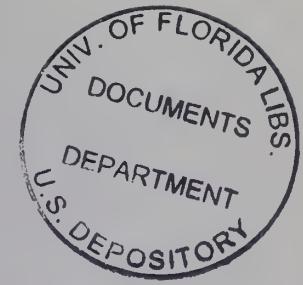


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DOD COST REDUCTION AND MANAGEMENT IMPROVEMENT PROGRAM



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Defense Management Journal

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The Defense Management Journal is published quarterly by the Directorate for Cost Reduction and Management Improvement Policy, Office of the Assistant Secretary for Defense (Installations and Logistics), for distribution within the Department of Defense.

The Defense Management Journal seeks to stimulate cost reduction ideas, promote cost consciousness, and enhance understanding of efficiency programs. The Journal's content includes: (1) cost reduction goals and accomplishments; (2) policies and procedures of the cost reduction system; (3) cost reduction techniques and processes in all functional areas from which savings are derived; (4) new developments in concepts and philosophy that affect cost reduction objectives; and (5) specific cost reduction examples, with attribution where appropriate.

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Barry Shillito recently became the Assistant Secretary of Defense for Installations and Logistics. The Defense Management Journal asked him:

WHERE DO WE GO FROM HERE?

Good question. Only amateurs confuse changing the guard with removing the watch. The pro's know that smart tacticians never relax the vigil.

The Cost Reduction and Management Improvement Program is a prime observation post. It alerts logistics management to pitfalls and it supplies some mighty cogent answers to fundamental questions.

It is a "performance" program—one that mirrors our successes and our shortcomings in 42 critical areas of logistics management. Nineteen cost reduction areas reflect the dollar savings impacts of employee ingenuity. Twenty-three management improvement areas show logistical effectiveness by appropriate indicators other than dollar savings. As we acquire data under existing and still to be added management improvement areas, we expect to develop some quite incisive analyses. I look to the management improvement segment of the Program to provide a solid basis for shaping logistics policy. What we have is a system for spotting critical areas, firming up objectives, setting the right course, calculating our headway, and correcting direction when the signals call for it.

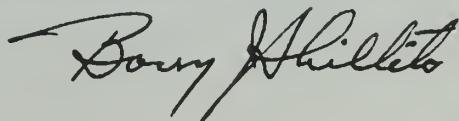
That, however, is only part of the story—the part that gives us a useful overview of the way we run our logistics business and the part that provides valuable insights into specific logistics problems.

This Department's cost reduction history conveys a second, more important message. That message is implicit in the sheer volume of management improvements recorded every year—25,000 to 30,000 of them. This flood of innovation shows how well management—up and down the line—has been able to recruit the talents of all our people to the vital mission of supporting our combat forces more effectively and at less cost. That, to me, is the ultimate proof of a worthwhile management system.

There are plenty of challenges ahead, and—to meet them—you can be sure that this Program's objectives will receive the strongest backing.

- Recently President Nixon said: "It is absolutely essential that the most effective use be made of all the country's resources in achieving the Nation's goals and that governmental functions be accomplished with the least possible waste."
- On January 24, Deputy Secretary of Defense David Packard approved cost reduction goals of over \$1 billion for fiscal year 1969. In transmitting these goals to the Secretaries of the Military Departments and the heads of Defense agencies, he said: "In my view, the Cost Reduction Program is an effective tool for motivating your managers and evaluating their performance . . . I have asked the Assistant Secretary of Defense for Installations and Logistics to report to me each quarter on progress in this Program."

The signals are loud and clear. I am sure they will be heeded.



THE SECRETARY OF DEFENSE

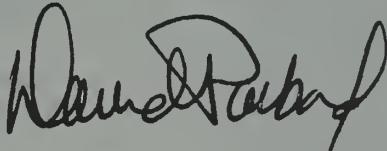
WASHINGTON

January 24, 1969

MEMORANDUM FOR THE SECRETARY OF THE ARMY
SUBJECT: Department of Defense Cost Reduction Program—
Goals for FY 1969 and FY 1970

I am concerned that we get value for every dollar the Department of Defense spends. I expect you to emphasize this point to all of your personnel—most particularly to those who execute Defense contracts and administer our logistics programs.

In my view, the Cost Reduction Program is an effective tool for motivating your managers and evaluating their performance. That Program's goals for your department for the current year, as developed by your staff, are attached. I have approved them. If these goals are achieved, I will have good assurance that we are managing our resources effectively, efficiently and economically. For this reason, I have asked the Assistant Secretary of Defense for Installations and Logistics to report to me each quarter on progress in this Program.



DAVID PACKARD,
Deputy.

Similar letters went to all military departments and
major defense agencies.



An UH-1D Iroquois (Huey), the logistics Jack-of-all-trades in Vietnam, speeds the author (center) to Stateside on-site inspections.

PROJECT MACONOMY

By GENERAL W. C. WESTMORELAND
United States Army
Chief of Staff

INTRODUCTION

The winter issue, 1967-68, of the Defense Management Journal announced the inception of Project MACONOMY by making reference to a message, dated 29 October 1967, that I had, as COMUSMACV, sent to the Secretary of Defense. In response, the Secretary of Defense had enthusiastically endorsed such a cost reduction program to be undertaken in a combat zone by commenting, "Due to the scope and speed of the Vietnam logistic buildup it was to be expected that we would have many opportunities for improving the management of inventories, facilities, and logistic support activities. Your plans for a vigorous, imaginative attack on these problems will, I am sure, produce substantial savings in men, money, and materials." The Secretary of Defense, at this time, also pledged his full personal support and that of all Defense officials in this effort to be undertaken in MACV.

It has been just 1 year since Project MACONOMY was initiated, and I believe that a progress report is appropriate. I hope that the achievements made and the momentum gained by our commands in Vietnam in support of the project's objectives will be as encouraging to you as they have been to me. It is a pleasure for me to present this report.

PROJECT MACONOMY

PRIOR TO October 1967, the efforts of the Military Assistance Command-Vietnam (MACV) were primarily directed toward determining and justifying optimum force structure and accelerating the in-country logistical buildup, while simultaneously conducting combat operations against the enemy. Although economies were effected during this buildup phase, there was no formally established program for achieving management improvements. With the logistical buildup nearing completion in calendar year 1967, I felt that it was an opportune time to establish a program for the achievement of greater management effectiveness among all elements and at all levels within MACV. Therefore, a priority program was initiated in October 1967 to identify specific areas in need of management improvement and to stimulate a competitive and vigorous pursuit of imaginative management practices.

Integrates Efficiency Efforts

This formally organized program designated "Project MACONOMY" is designed to be carried out under the most challenging conditions of a combat zone and to support my policy of developing a well-balanced, hard-hitting, efficient military force which can be sustained at a minimum cost for an indefinite period. From the outset, the project put pressure on all levels of command to get the most out of every resource allocated to us.

While MACONOMY is directed at achieving the most effective utilization of all resources throughout all commands in Vietnam, it in no way relieves component or uniservice commands of the necessity for participating in service-sponsored cost effectiveness programs. Instead, it is aimed at providing a comprehensive program to provide coordination, integration, and the mutual exchange and dissemination of management improvement innovations and concepts resulting from individual management actions in the conduct of management effectiveness programs. More specifically, Project MACONOMY is aimed at:

1. The elimination of malpractices and non-adherence to established logistic policy.
2. Analysis and revision of logistic systems and management practices to correct or improve logistic support structure, concepts, and doctrine.
3. Achieving maximum management effectiveness in the Command while insuring responsive and uninterrupted support of the combat mission.
4. Improvement of management and operating practices in all echelons and the stimulation of positive management improvement actions to insure the achieve-

ment of requisite military capability at the most economical cost.

5. Establishing a reporting system that will provide a method for identifying, documenting, verifying, and reporting the effects of management improvement actions; and to measure progress against the program objectives.

6. The encouragement of personnel motivation by providing command attention and support to the implementation of this project at all levels within MACV.

Project MACONOMY, although new in name and formalized with detailed analysis and recording procedures, is basically the consolidation of many current aggressive programs aimed at increased management and cost effectiveness. MACONOMY, therefore, serves at MACV's vehicle for giving added impetus and status to these programs and, more important, to promote and exploit to the maximum extent new economy measures.

Pinpoints Responsibilities

The Comptroller, MACV, was designated as the principal contact for Project MACONOMY and was charged with the responsibility for its implementation and direction of its execution. MACV staff members and major commanders were directed to establish policies, objectives, plans, and programs and to provide guidance as required for the adaption of Project MACONOMY to their particular missions. In the execution of Project MACONOMY, managers at all levels continually review plans and programs, analyze, and evaluate methods to achieve increased operational capability at the most economical cost in men, money, and materials. A program coordinator has been appointed by each staff element and by each major command to develop and assist in carrying out plans in support of Project MACONOMY. In addition to the inherent capabilities of the various staff elements for analyzing operations and developing improved management methods, proven standard techniques such as work measurement, linear programming, zero defects, PERT, work simplification, and an incentive awards program are used to the maximum extent in achieving the desired objectives.

I will not elaborate on the collection, analysis, and reporting procedures used in Project MACONOMY for they are, in effect, not unlike those procedures used in similar programs.

Sets Measurement Criteria

However, to gain a better appreciation for the validity of the savings achieved by Project MACONOMY, I should mention that all reportable cost effectiveness

savings must be derived by determining the cost effect of individual management improvement actions which are categorized as one of the following type actions:

1. *New Management Actions*.—Those internally originated procedures, policies, innovations, or decisions which, when applied for the first time, reduce or gain better utilization of resources.

2. *Improved Management Actions*.—Those changes in existing procedures, policies, and techniques which, when implemented, reduce or gain better utilization of resources. Actions which have been previously applied, but which have been revised, changed, or otherwise improved are included in this category.

3. *Intensified Management Actions*.—Those unusual, accelerated, or broader applications of existing policies, procedures, and techniques which, when implemented, reduce or gain better utilization of resources.

The cost effect is determined by comparing the cost "before" the action was taken versus the cost "after." To arrive at such cost figures, the most appropriate techniques and the latest available data are used; however, generally accepted sampling techniques and methods are used for the determination of projected savings. The cost effectiveness of a management action involving the transfer of a job, operation, function, or activity from a commercial contract to in-house is derived by comparing the contract cost with the total cost—to include labor, materiel, and all indirect costs—which will be incurred to perform the job, operation, function, or activity.

It is anticipated that some management improvement actions may reduce the costs of one activity or component, but at the expense of increasing the cost to another activity or component. In these instances all readily identifiable cost impacts, both increases and decreases, are considered in the saving computations. Only the net savings are reported by the activity or component benefiting from the overall action. While most management improvements do result in an identifiable monetary, manpower, or material savings—and are reported as such—some new, improved, or intensified actions do not produce an identifiable reduction in cost. Yet, these actions may do much to improve operations and result in increased effectiveness or better utilization of personnel, facilities, supplies, or equipment. Management actions in these cases are reported as "other benefits."

Concentrates on Target Areas

Like any new program, the mere publishing of a directive does not by itself assure success and achieve the desired goals. This fact was recognized at the inception of MACONOMY. But, by tying the cumulative efforts together with appropriate command emphasis and widespread recognition of the aims and

achievements, Project MACONOMY did make significant progress toward achieving its initial objectives.

Some typical areas of interest studied under Project MACONOMY were the:

1. Critical evaluation of PEMA principal item authorization.

2. Reduction of ordering time for small arms and crew-served weapons.

3. Reduction of stockage objectives.

4. Evaluation of materiel and improvement of facilities for the receipt, preparation, and movement of retrograde cargo.

5. Identification and turn-in of excess authorized equipment.

6. Improvement of contract administration and supervision with particular emphasis on advance procurement plans.

7. Reduction of airlift costs through the implementation of an airlift priority challenge system.

8. Review and reduction of communication and electronic requirements for base support communications throughout Vietnam.

9. Review and adjustment of administrative and housekeeping support within MACV.

10. Development of a purge list of "nice to have" items in PX stocks which will result in reduced warehousing and a one-time saving in stock levels.

The fiscal year 1968 year-end report published by the U.S. Military Assistance Command, Vietnam, estimates that the 130 management improvement actions taken during the year resulted in money and materiel savings of approximately \$512 million and the alignment of 7,400 manpower spaces for improved efficiency. It also shows every military component—Army, Navy, Air Force, and Marine Corps—participating.

Achieves Results

While the individual management improvement actions taken during fiscal year 1968 are too numerous to cite, I have selected the following summaries, from a message recently received, to illustrate the magnitude of accomplishments during the first calendar year of Project MACONOMY operation:

1. *U.S. Army, Vietnam*.—The U.S. Army, Vietnam, achieved significant results through a concentrated review of command, personnel, and supply management techniques. Automated procedures and analysis were introduced at no additional cost in personnel or equipment. Techniques implemented resulted in a 50 percent reduction in requisitioned items, despite the increase in enemy activity throughout the area. An intensified management program of retrograde materiel was also introduced. Special directors were designated to manage serviceable excess materiel that was later reclaimed for the Army supply system in lieu of being sold as scrap or destroyed. With the increase in demand for operational personnel, the command estab-

lished an aggressive personnel management program which resulted in a substantial reduction of support personnel. During the past year, a conscientiously applied program of command, supply, financial, and personnel management within USARV resulted in a savings of \$241.5 million and 5,999 manpower spaces.

2. *U.S. Naval Forces, Vietnam*.—U.S. Naval Forces, Vietnam, pursued a vigorous program of management improvement designed to increase effectiveness while reducing cost, duplication, and waste. The emphasis placed on cost effectiveness by the Command resulted in the implementation of several new management techniques which not only eliminated numerous man-hours, but resulted in substantial monetary savings. By careful documentation of the effectiveness of these procedures, and dissemination of the cumulative and tangible results therefrom, all echelons of the command benefited by the savings of \$810.9 thousand and 159 manpower spaces.

3. *Seventh Air Force*.—The 7th Air Force systematically analyzed its internal management programs at all levels with the consequence of substantial manpower and monetary savings. The results of their efforts were commandwide savings in money, manpower, and materiel and improved operational capabilities at all levels within the 7th Air Force. For the year, the 7th Air Force achieved savings of \$176.9 million and 730 manpower spaces.

4. *III Marine Amphibious Force (IIIMAF)*.—The III Marine Amphibious Force made significant ac-

complishments in management effectiveness projects and intensified management practices. Reports indicate that much progress has been made particularly in the areas of personnel utilization, supply management, and other managerial improvement throughout the command. While no dollar or manpower savings were addressed, the actions taken under Project MACONOMY resulted in better personnel and supply management.

Sets Stage for Future

Although the results achieved through the dedicated efforts of MACV staff agencies and component commanders are indeed impressive, I believe that this is only the initial thrust. I am convinced that momentum will continue to grow as the cumulative and tangible results of new, improved, and intensified management improvement actions are documented and disseminated. I also believe that continued emphasis and cooperation among commanders and managers at all levels in Vietnam will identify more areas where additional savings can be realized. I know that MACONOMY will continue to play an ever-increasing role as a clearinghouse for the exchange of useful management ideas and practices which will serve to stimulate imaginative thinking and be the inspiration for an even more vigorous pursuit of improved managerial practices.

Project MACONOMY is off to a good start. The record of the first year not only speaks for itself in achievements but, in my opinion, heralds even greater accomplishments in the months ahead. □

\$1,400 AWARD FOR UNIT CLOSEOUT

James C. Dowdell of Elizabethtown, Ky., received a \$1,400 cost reduction award, the largest ever presented here, in recent ceremonies. Maj. Gen. James W. Sutherland, Jr., Commandant, The Armor Center, presented the check and a certificate to Mr. Dowdell, who is em-

ployed as a resources management officer at Boatwright Ordnance here (see photo below). Mr. Dowdell was rewarded for suggesting abolition of the vehicle recovery section of Boatwright Ordnance because its functions duplicated those of another unit.



Of Bills, Boons and Candles

A Disquisition on Yankee Ingenuity

In which a scholar of great esteem does discuss a colonial at court in Bavaria who did reap ample reward by instrumenting actions new, improbed and intensified which did cause potatoes to be made palatable and did induce reforms in society pleasing to all.—Editor.

A Discourse by:

DR. CRAIG M. CRENSHAW

Chief Scientist

Army Material Command

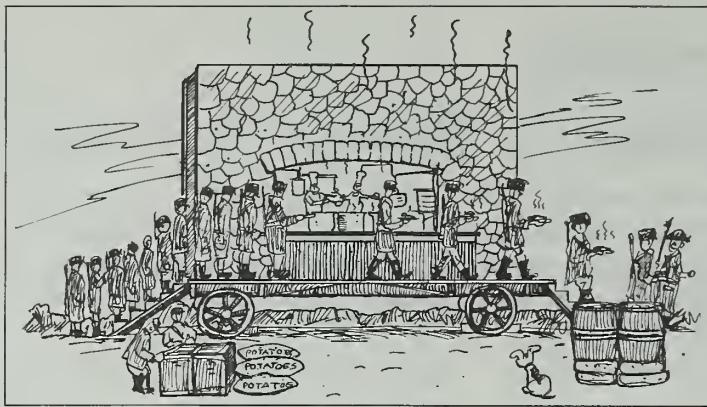
Department of the Army



To a large number of people connected with the military establishment, incentives are a new thought. However, incentives were used quite effectively in Colonial times—sometimes with outstanding results.

One typical method was to give a letter of commission from the British Crown to a colonial authorizing him to raise and equip a regiment, paying him so much a head for the troops in the regiment for each month of the battle or campaign.

Benjamin Thompson, through influence, was able to obtain a major's commission in the English Army. When his regiment was defeated in battle, he had to flee to England for safety. Major Thompson was a rather persistent individual who was continually pointing out mistakes in operation of the English government. In a short time, he made a nuisance of himself. However, since he had been a loyal colonist and a strong Tory who had fought for the crown, something had to be found to keep him busy. As a result, the English king offered him to the Elector or ruler of Bavaria as a military expert and retired Thompson as a lieutenant colonel at half pay. Upon his arrival in Munich, the Elector of Bavaria turned over to Thompson the equipping of the Bavarian Army with the stipulation the supplies should be improved. The army was to be increased somewhat in size, but the same appropriation would be furnished to Colonel Thompson and he could pocket any difference as long as the effectiveness did not decrease. This is 100% sharing of savings.



Development of portable stove.

In an army, for military effectiveness one considers the following typical order of priorities: Manpower, weapons, other equipment, clothing, food, and fuel. Colonel Thompson soon found out that for his interest the order should be reversed since the maximum expenditures were for food, next for fuel, with a peak in winter months, and then for clothing also peaking in winter months. Next at a lower level of expenditure were capital investments in equipment and weapons. The salaries of the men were fixed.



He proceeded to look into the manner in which fuel was used. It was used for cooking the year round and for heating quarters in cold weather. In a bivouac three or four soldiers would get together, light a campfire, and support a pot to cook food over the campfire. The continual daily outgo of money for food and fuel prompted Colonel Thompson to look for a more efficient method of cooking. As a result he developed a portable enclosed stove for cooking in the field. He theorized that cooking for small units was less efficient than cooking for large units. Since the major cost for food was when soldiers were in fixed quarters and not on maneuvers, he started to have meals cooked centrally and served to large units of men. Having come from the new world, he was familiar with potatoes. Potatoes, in that day and age, were not acceptable in Bavaria or anywhere in Europe as an edible food. Thompson realized that potatoes made a very effective base for stew. He hired non-Bavarian cooks, bought and imported potatoes secretly which were cut up very finely and added to the stew to give it body. He swore the cooks to secrecy and did not divulge the contents of his special stew for a long time. This prevented riots by the soldiers, since potatoes were considered poisonous by Europeans at that time.

With the food under reasonable control as to cost, Thompson turned his effort to improve the effective-

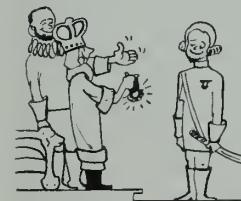
ness of fuel use. He improved the stove for cooking. In his experimentation he realized a water jacket surrounding a pot of stew or vegetables would work at a lower temperature, use less fuel, and cook more effectively. As a result, he invented the double boiler. However, fuel was used for heating as well as for cooking, and in the winter large amounts of fuel were consumed. He next turned his attention to consumption of fuel for heating. He noticed that a large amount of heat escaped up the chimney and that no effective heat transfer was available from chimney to the room. As a result, he studied heat transfer and developed the first hot air circulating heating system. There were large hot air ducts running from the floor over the stove or fireplace, and back near the ceiling, causing the air to circulate, by convection. He was able to reduce the cost of fuel to heat the barracks. As a bonus he obtained more uniform heating, as well as the savings in fuel cost.

Having made a major profit from both food and fuel, he then decided to turn to the third major cost item; namely, clothing. He wondered if cloth of the day could be improved. Felt was used. Felt is a heavy matted cloth material compressed to solid flat sheet. He realized the problem was to keep the heat of the body from being dissipated into the surrounding atmosphere. At that time the fluid theory of heat was in vogue but he had some doubts as to this. He developed a calorimeter, which is very similar to the one used in General Physics Laboratories today, to determine heat flow through felt. He tried other type materials, one of which was a loosely woven wool rather than the pressed felt. He discovered by his measurements that loosely woven fibers of the same material used for felt would reduce the heat flow for the same weight, thus indicating a cost savings. He ordered the next set of winter uniforms of loosely woven material. When they were delivered they were the same pressed felt used in previous years. Thompson found it was impossible to convince the clothmakers of that day that any cloth could be warmer than felt and to get them to make a loosely woven cloth.



With his improvements up to that time he had become highly favored and was very influential at court but was unable to break the guild system of clothmakers. He decided he would invest a portion of his savings into making a clothmill of his own to manufacture the type cloth he wished for the uniforms. He obtained several large buildings in which to house labor and manufacture cloth. He did not wish to spend any more money on wages than necessary. At that time in most European cities there was a slum population which contained a large number of criminals and ne'er-do-wells. A large fraction of this group would be drunk in the streets on any holiday or celebration. This group appeared to him as a good source of people to use in his manufacturing. On one New Year's Eve he had all vagrants and drunks in Munich arrested. Then as a philanthropic gesture he agreed to take them out of toils of the law and vouch for their support and house them. He made them work for him as a type of indentured servitude, living in his dormitories. He realized these unskilled laborers would not be able to make fine cloth until they had been well trained. At first they only made coarse cloth. After many months of training the better workers were converted to making cloth of adequate quality for Bavarian Army uniforms. Thus, Thompson was able not only to pocket profits of the clothmaker, but also profit from the reduced weight of raw material used. He thus obtained a reputation for being a great helper of the poor, since he had removed the vagrants and many criminals from the streets of Munich.

In monitoring his cloth manufacturing organization, he discovered the price of candles in winter months was very high and he proceeded to invent a shadow photometer to determine the most effective lighting to use and thus conserve funds.



Although Mr. Thompson was a colonel in the British Army, the lack of a title of nobility and its attendant entry into all of society bothered him. During his stay with the Elector of Bavaria, the Vicar of the Holy Roman Empire died. Prior to selecting the next Vicar, the Elector of Bavaria was given the prerogative of the office on a caretaker basis. In this capacity he dubbed Benjamin Thompson a Count. One of the advantages was that Holy Roman Empire titles could be given to people of any nationality and also they did not need to have a castle or grounded estate to accept such a title.

Thompson took the name Rumford; thus Benjamin Thompson became Count Rumford.*

His newly acquired title was the last straw to most members of the Bavarian court. Soon afterward, the Elector died. After installation of a new Elector, Count Rumford found it expedient to leave Bavaria expeditiously.



Count Rumford continued his career in London, continued to invent more effective household equipment, to organize projects for the poor (all of which ended with more funds in his pocket) and to make enemies. When his welcome wore thin in London he toured the Continent and finally married the widow of Levesier (a famous French scientist) and settled down to somewhat hectic life in Paris. One London newspaper reported the event as a typical Rumford venture for a large profit since Mme. Levesier was extremely wealthy.

The 100 percent sharing of Benjamin Thompson, Count Rumford, proved to be a major incentive for him. In his experience of improving the effectiveness of equipping the Army of Bavaria he used a critical scientific approach to determine the facts of the situation and invented many measuring devices to obtain true and consistent data. (Most scientists will remember Rumford for his proving the caloric theory of heat false in his famous cannon-boring experiment.) Following these leads, he devised more effective means, primarily in the use of consumables to secure savings for himself. In so doing he made himself unpopular; however, this should be attributed to his personality more than to the nature of his accomplishments. □

*Wherefrom the founding fathers of a hamlet ensconced in northeast colonial territory did derive the village name which remains to this day Rumford (population, 8,500) in the State of Maine.

Count Rumford found it expedient to leave Bavaria expeditiously.



LCC ARRIVES FOR MAJOR SYSTEMS

"... it is impossible to deny the logic of considering total anticipated life cost (rather than merely purchase price) in procuring hardware."

WHEN "Life Cycle Costs: an LMI Study" appeared in the spring 1966 issue of the Defense Management Journal, Life Cycle Costing was regarded by many as another fad based on a *buzzword*. "Don't worry; it will go away," was a typical comment. Now more than 3 years have passed since the Life Cycle Costing Test Program was established, and the buzzword is more in vogue than ever. The number of people involved and the number of applications are still steadily growing, and in some areas it has become a foregone conclusion that Life Cycle Costing will become routine practice.

Life Cycle Costing has not had the usual impact of a buzzword. It has not shocked people into making sudden changes, but has slowly gained acceptance as a commonsense way of doing business. Part of the reason is that it is impossible to deny the logic of considering total anticipated life cost (rather than merely purchase price) in procuring hardware. Another rea-

son is that many people, under the guidance of the DoD Life Cycle Costing Steering Group, have worked diligently to find practicable ways of implementing the logic.

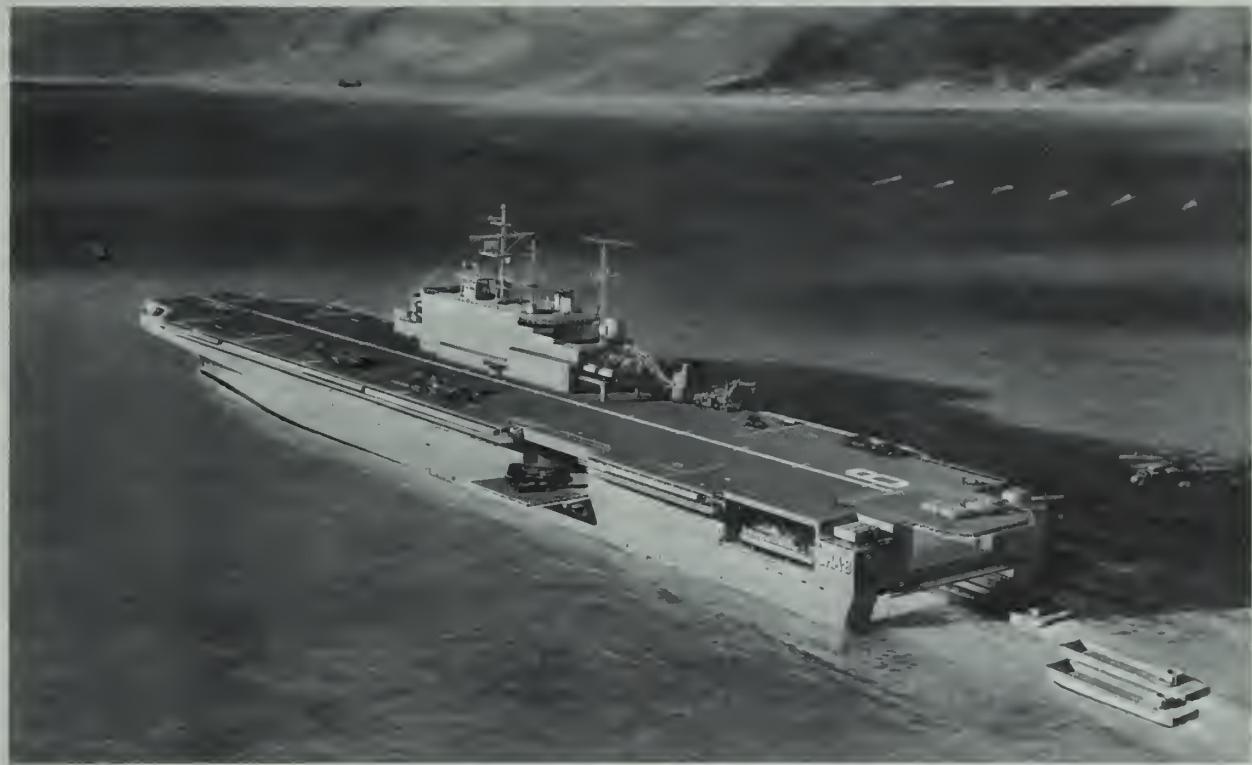
LMI has served as consultant to the Steering Group since the summer of 1965. On the basis of that experience, some reflections and observations can be made.

Success With Nonreparables

It was no surprise that the majority of cases early in the Test Program involved nonrepairable equipments purchased on a price-per-unit-of-service-life basis rather than merely on the basis of unit price. Batteries were bought on the basis of lowest price per charge-discharge cycle. Film resistors were bought on the basis of price per operating hour. The contract award criterion for Klystron tubes was the sum of price and special tooling cost, divided by service life. Aircraft tire contracts were given to companies whose tires had the lowest price per landing. Other cases had similar award criteria.

Cost savings as a result of Life Cycle Costing on non-reparable equipments were dramatic and easy to establish. Defense of the award criteria has not been difficult. Hence the use of such criteria has grown steadily.

*By WILLIAM F. FINAN
Executive Vice President
Logistics Management Institute*



The General Purpose Amphibious Assault Ship (LHA) is a primary test bed for life cycle costing. An artist's concept of the LHA is pictured above. The LHA will combine the features of the Amphibious Assault Ship (LPH), The Amphibious Transport Dock (LPD), The Attack Cargo Ship (AKA) and the Dock Landing (LSD), with a full flight deck and a well for landing craft and a balanced payload. It will have a length of 796 feet, a beam of 106 feet, and a speed in excess of 20 knots.

ily, and the rate of growth has accelerated particularly within the past year.

Another Success

Contrary to expectations the second Life Cycle Costing area of application to gain broad usage has been major systems. The use of Life Cycle Costing in that area no doubt came partly from recognition that a long stream of large expenditures is influenced by major system contract award decisions. It came partly from assignment to project offices of resourceful people who welcomed a new challenge. It also came from the use of Contract Definition, which provides an almost ideal framework for Life Cycle Costing activities.

The Navy has served as a primary test bed, with use of Life Cycle Costing in the FDL, LHA, ASMS, VS(X), and DX/DXG programs. All the military departments have, however, participated in the learning process and all are applying the methodology developed, as well as testing new techniques, in current programs. Planning for new programs indicates widespread acceptance of Life Cycle Costing as a way of doing major system business.

The military departments have demonstrated that Life Cycle Costing procedures can be made practicable

and that contract awards made on the basis of Life Cycle Cost will stand up. Acceptance of those points is essential before estimated total life cost, rather than just system acquisition cost, can be expected to appear routinely as the economic criterion in proposal evaluation.

The largest payoff of Life Cycle Costing, however, probably does not come in proposal evaluation itself. Experience of military department personnel in the design reviews of Contract Definition Phase B (see Figure 1) indicates that a larger benefit is obtained from motivating contractors to use total system life cost (rather than merely acquisition cost) in their design trade-off analyses. The result is a better set of preliminary designs from which to chose—better from the standpoint of the longrun interest of the Government.

An overview of Life Cycle Costing in major system acquisition programs can be provided by summarizing a few key steps. To provide a concrete framework for discussion, and one that is in keeping with current DoD practice, let us define a "major" system to be one which goes through Contract Definition. Further, let us assume that Contract Definition culminates in a Total Package Contract (i.e., a combined development and production contract). The steps listed in this article

will not be found in any DoD Directive or Instruction or in any military department regulation manual or guide. There are no official DOD or military department Life Costing procedures. Life Cycle Costing still is a Test Program; and the Test Program leaders have insisted that ample study and experimentation be concluded before policy and procedures are decided upon. Nevertheless it is my observation that the steps described are well on their way to becoming standard practice. To assist the reader (hopefully), figure 2 is included to show when the various steps occur.

The Element Structure

The first step in using Life Cycle Cost in a major system acquisition is to develop an element structure. To assure completeness of contractors' Life Cycle Cost estimates, it is necessary for the procuring activity to specify a list of elements, or categories, whose costs must be calculated. To permit meaningful comparison of contractors' estimates on an element-by-element basis, definitions must be provided for all elements.

The Life Cycle Cost Element Structure may thus be considered a chart of accounts which contractors follow in preparing their cost estimates. It differs, however, from the type of chart of accounts we associate with financial accounting procedures, in that it is structured to facilitate analysis of cost and of the relationships between cost and system performance. It is not necessarily a convenient framework for preparing budgets or for accumulating actual cost experience.

The element structure may be separated into four parts—Concept Formulation and Contract Definition, Total Package Contract, Other Government Investment and Operation and Support. The Concept Formulation and Contract Definition part covers all costs prior to award of the Total Package Contract. The Total Package Contract part includes all costs covered by that contract. Other Government Investment encompasses all noncontinuing costs of acquiring the system and a capability to operate and support it, exclusive of costs in the Total Package Contract. The Operation and Support part of the structure includes all continuing costs of the system, except those covered by the Total Package Contract, during its anticipated service life (or during a specified costing period). For the convenience of avoiding another category, Operation and Support may also contain costs of retirement or disposal of the system.

The first part of the structure—Concept Formulation and Contract Definition—is provided only for the purpose of covering all primary components of Life Cycle Cost. Costs of that part are already incurred by the time the Total Package Contract is awarded, so they should not play a role in the award decision.

With the exception of continuing contractor support included in the Total Package Contract, the element

breakdown of Total Package Contract and Other Government Investment should correspond to the Work Breakdown Structure used during Contract Definition. In fact, an effort to develop those two parts of the Life Cycle Cost Element Structure should not be separated from effort to develop a Work Breakdown Structure, and the products usually should be identical.

Work on an element structure should begin prior to Contract Definition, so that a tentative structure can be included in the Request for Proposals which begins Phase A. That tentative structure should anatomize the system to three or four levels of detail. Definitions for each identified cost element should accompany the structure. The definitions should provide guidance for establishing additional levels of detail.

The Request for Proposals should invite Contract Definition offerors to recommend changes in the tentative element structure and extension of the structure, perhaps to two additional levels. The structure should be made final in the Contract Definition contracts, and should be common among all such contracts negotiated.

Cost Factors

Some of the factors required to develop Life Cycle Cost estimates are not under the control of contractors; i.e., they do not vary among different system designs. Examples of such factors are: pay rates of military personnel, unit cost of fuel, and charges for use of existing Government support facilities.

To assure that competing contractors use the same values for those cost factors, and to assure that the values are accurate and current, the procuring activity should provide the values to Contract Definition contractors.

Ideally the cost factors should be given to offerors in the Request for Proposals, so that errors in early projections of Life Cycle Cost are kept as small as possible. At the present time, however, it may not be possible to develop all the factors at that time. At the minimum, cost factors should be identified by name; as many as possible should be quantified in the Request for Proposals; and all others should be quantified by the time of Contract Definition contract awards. As a history of Life Cycle Costing procurements accumulates, new procurements can draw on the work of past procurements, and cost factors should eventually be presented in complete form in Requests for Proposals. Improved cost data collection should facilitate the achievement of that goal.

Costing Rules

In addition to an element structure and cost factors the procuring activity should specify a set of costing rules. Those rules should be provided to the offerors in the Request for Proposals. They should be subject to change until the signing of the Contract Definition contracts, but not allowed to differ among those contracts.

One of the costing rules should give the costing period. That period should equal the design life of the system. If the design life is not specified in the Request for Proposals or in the Contract Definition contracts, except as a minimum value, the Life Cycle Cost estimates of different contractors could cover different time spans. In order for comparison of such estimates to be fair, design life should be included in the evaluation criteria for system performance.

An alternate way of allowing for differences in design life among the Contract Definition contractors' proposals is to calculate residual value. The procuring activity could stipulate a fixed costing period and establish rules for residual value computation based on additional life. Such a method probably is more difficult, however, than using a variable costing period.

Many of the costing rules are needed to simplify the analysis, presentation, and review of the timing of costs. One rule should specify whether costs should be presented by fiscal year, by calendar year, or by another clearly defined time interval. Another rule should tell whether Total Package Contract costs should be counted when they are incurred by the contractor, when they are invoiced to the Government, or when they are paid by the Government. Another rule should state whether the cost of Government-furnished material and equipment should be counted when that cost is incurred by the Government, when the material or equipment is delivered to the contractor, or when the system is delivered to the Government. Still another rule should stipulate whether overhaul costs should be counted when the overhauls begin, when they are completed, when the costs are invoiced, or when they are paid by the Government (assuming that the work is performed by contractors). Similarly, rules are needed for the timing of other types of cost.

A rule should specify whether progress payments are to be considered in estimating the stream of costs. Directions should be given for the inclusion of any costs which might occur before the start of the costing period.

If the costs of future modifications are to be included in the Life Cycle Cost estimates, a rule should be given to so instruct the contractors and present or reference assumptions about the modifications. In most instances it would seem more logical to direct the Contract Definition contractors to estimate costs on the basis of replacement by like kind when equipment wearout occurs, since modifications must be justified on a cost-effectiveness basis as they are proposed.

Offerors, and subsequently Contract Definition contractors, should be told whether to estimate costs in terms of constant dollars or variable dollars. If the constant dollar approach is used, a base date should be given. If variable dollars are to be used, an escalation rate should be specified.

Rules for the discounting of future costs should be

included. A rate should be stipulated and, to avoid any misunderstanding, a table of annual cost discount factors should accompany the rules.

Finally, suggested formats for contractor presentation of Life Cycle Cost estimates should be provided, along with instructions. If additional cost or other data are required to explain or justify Life Cycle Cost entries, the form of those data also should be indicated.

Methods of Credibility Assessment

There are at least three important reasons for trying to reduce the risk of having Life Cycle Costing errors: (1) Such errors could lead to selection of a system other than the one which is most cost-effective; (2) such errors could result in an evaluation which is unfair to one or more of the Contract Definition contractors; and (3) such errors could lead to protest actions and an overturning of the Total Package Contract award decision. The problems associated with verification of Contract Definition contractors' Life Cycle Cost estimates differ for the three broad categories of cost—Total Package Contract, Other Government Investment, and Operation and Support.

The desire to win the competition for the Total Package Contract tends to force the contract price down, while the necessity to cover costs and earn an adequate profit tends to force it up. The result should be realistic contract price proposals. Customary scrutiny of proposals and price negotiation are adequate safeguards in this costing area.

Other Government Investment is a category for which the Contract Definition contractors need much assistance from the Government. Government-furnished equipment requirements and schedules are jointly established. As the dialog of Contract Definition phase B progresses, through design reviews and other information exchanges, Government personnel are able to identify those facilities acquisitions, conversions, and modifications required for the system. They also can identify such other needs as training, tests, data, and spares; and they are able to estimate the costs of Other Government Investment with sufficient accuracy for phase C evaluation purposes. In fact, the Government may provide some of the cost estimates to the contractors during phase B. Therefore the validation of Other Government Investment estimates does not present severe problems.

Verification of Operation and Support costs presents, however, very difficult problems. Competition tends to force the cost estimates down, but there is no countervailing force to assure that the estimates will not be unrealistically low. Available experience data generally are not adequate to sustain an assessment of the credibility of many of those estimates; and a detailed review of each contractor's buildup of all cost estimates is not possible within the constraints of time, manpower, and other costs. A combination of several other

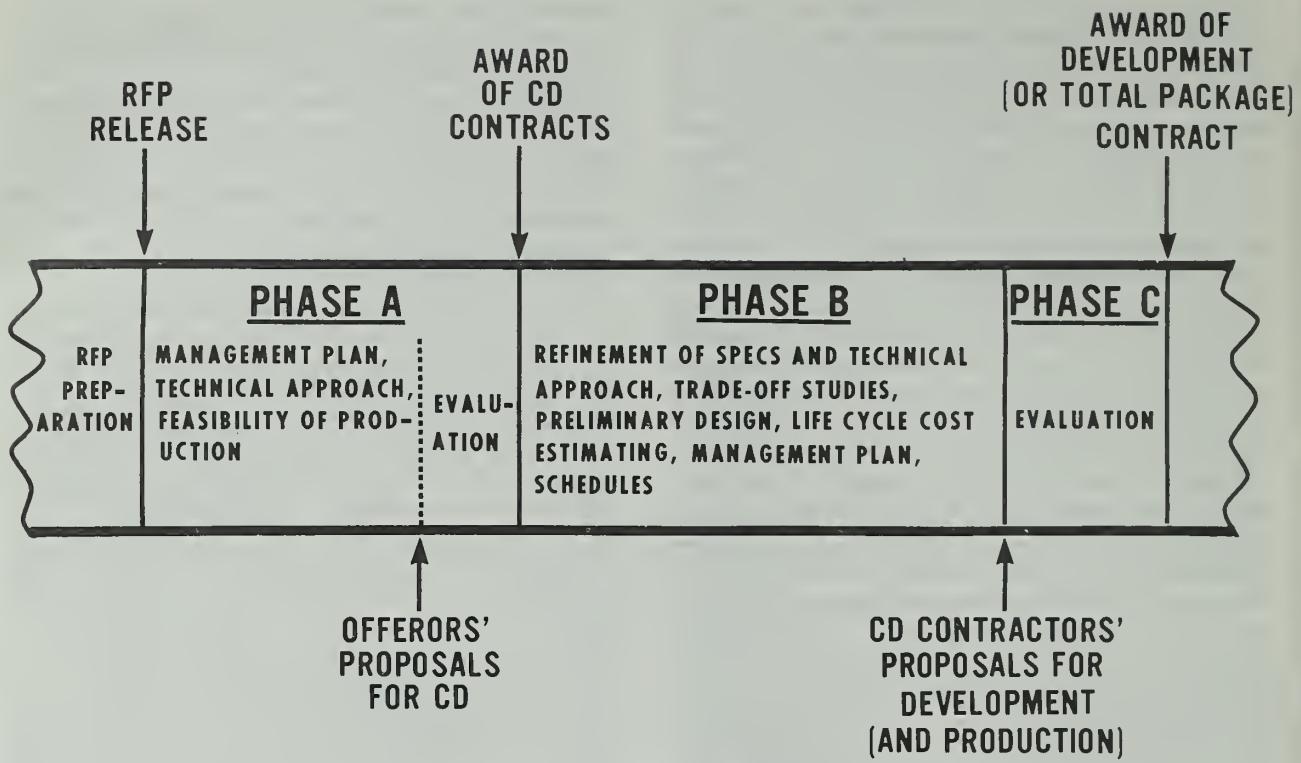


Figure 1—CONTRACT DEFINITION

types of verification is called for to supplement detailed examination of selected estimates.

One means of verification is careful review of the trade-off studies required by the implementing instructions for DoD Directive 3200.9, *Initiation of Engineering and Operational Systems Development*. An advantage of using the trade-off studies is that they give visibility into the accuracy of contractors' estimates without requiring scrutiny of large quantities of detailed supporting data.

Analysis can be made of the trading of increments in the cost of one element for increments of other elements. Consistency among the values given will attest to the validity of the cost estimate in question. Inconsistency will cause the credibility of the estimate to be suspect.

Cost increments for an element, as reported in trade-off study summaries, also can be compared with the total estimate for the element. Compatibility between incremental and total values will be an indication that the estimate is valid.

Another method for helping to assure the credibility of Operation and Support cost estimates is to assign penalties for failure to meet the estimates. The estimates can be included in the Total Package Contract, along with demonstration requirements and associated penalties, as special provisions. For such an approach to be practical, however, the demonstration tests to estab-

lish whether the estimates were achieved or exceeded usually must be completed early in the system's life.

The use of penalties for failure to meet cost estimates has a serious limitation in major system procurements. A small deficiency in satisfying annual unit cost estimates, multiplied by the number of systems and the length of the costing period, might amount to a total penalty that no contractor could bear. Penalty provisions which would compensate the Government, fully or in major part, for cost estimating deficiencies could not be negotiated into the Total Package Contract without huge contingencies in contract price. In reality, penalties which could be negotiated would represent cost-sharing of the estimating deficiencies, with most of the cost risk taken by the Government. Hence, the effect of penalty provisions in motivating realistic Operation and Support cost estimates may not be as strong as initially it would appear. In small programs and for selected cost elements, however, penalties can be effective.

Another approach to validating estimates is to have the competing companies estimate the Life Cycle Cost of an existing system—a "standard" system—with as many as possible of the characteristics of the new system. In that approach, each contractor is required to employ the same costing approach for the standard system as for his proposed system. Through comparison and analysis of different Contract Definition con-

	PHASE A			PHASE B	PHASE C
	RFP	OFFERORS' PROPOSALS	CONTRACTS FOR PHASE B		
ELEMENT STRUCTURE	tentative version	suggested revisions	final version	use in LCC estimating	
COST FACTORS	tentative list	suggested revisions	final list including values		
COSTING RULES	tentative version	suggested revisions	final version		
METHODS OF CREDIBILITY ASSESSMENT			description		use in evaluation

Figure 2—LIFE CYCLE COSTING IN CONTRACT DEFINITION

tractors' Operation and Support cost estimates for the same standard system, the procuring activity can identify and eliminate, for both the standard and proposed systems, cost differences resulting simply from differences in estimating assumptions and techniques. Further, by requiring explanations of any substantial differences between each contractor's estimates for the standard system and those for his proposed system, the activity can gain insight into the credibility of the proposed system estimates. If necessary, adjustments can be obtained from the contractors.

Use of any or all of the above credibility assessment techniques (or others producing similar results) decreases the procuring activity's problems in using and defending Life Cycle Cost as an award criterion. Moreover, adoption of such techniques makes it clear to competitors early in Contract Definition that Life Cycle Cost *can* be an award determinant. Hence it helps bring about the most important benefit of Life Cycle Costing in Contract Definition: The carrying out of the phase B design efforts with total system life cost in mind.

The Future

Life Cycle Costing has arrived in major system acquisition. Numerous programs already have demonstrated that a Life Cycle Costing effort can be made suc-

cessful by starting early, giving Contract Definition offerors and contractors clear guidance for Life Cycle Cost estimating, and making use of the dialog which exists between the Government and the contractors during Contract Definition. We can expect other programs to make use of that experience and to produce innovations and refinements that upgrade Life Cycle Costing methodology.

As major system acquisition programs incorporate Life Cycle Costing as a matter of routine, we can expect attention to turn to that area of application in which Life Cycle Costing has been least successful to date: Procurement of reparable equipments. Experience with nonreparables and major systems has caused many persons to believe that total life cost *can* be a contract award determinant in the purchase of equipments. Furthermore, people are becoming concerned that the benefits realized from improved approaches for buying systems will be eroded substantially if reprocurement of components is made on a lowest-unit-price basis.

The DoD Life Cycle Costing Steering Group already is leading the way in research on reparable equipments. Under its guidance, committees are studying techniques of potential utility, LMI and military department personnel are preparing case studies, and an NSIA Task Group is reviewing DoD products and contributing suggestions. □

VALUE ENGINEERING CONTRACT INCENTIVES:

Value Engineering Contract Incentives have been the center of some controversy since 1963 when they were first widely used. Is this partnership approach to cost reduction a government giveaway, or is it good business for both parties?

To gain further insight from both government and industry, the Defense Management Journal recently questioned Mr. George E. Fouch, Deputy Assistant Secretary of Defense (Logistics Management Systems and Programs), and Mr. Stephen Keating, president of Honeywell, Inc. Mr. Fouch is responsible for overall policy direction of the DoD Value Engineering Program. He has had extensive experience as a manager in industry as well as in government. Honeywell's Aerospace and Defense Group has submitted over 200 VECP's. More than 100 of these have been approved with estimated savings to DoD exceeding \$20 million. With this experience, Mr. Keating is well qualified to discuss VE incentive sharing.—Editor.

DMJ. Mr. Fouch, to orient our readers, perhaps you could start by defining the two elements of the contract sharing program that are basic to the controversy. What is a VE incentive clause, and what is a VECP?

FOUCH. A VE incentive clause is one which allows the contractor to develop and submit Value Engineering Change Proposals (VECP). No increase in contract execution cost is expected from inclusion of such a clause. As motivation, contractors receive a share of the savings which result from implemented VECP's. While the contractor's share of the savings is time limited, the government continues to benefit as long as the item is procured. Incentive clauses are used most often in production contracts over \$100,000 (excluding CPFF). The VECP itself is a cost reduction proposal, initiated by a contractor, which involves some change in the contract specifications, purchase description, or statement of work. The key phrase here is change to the contract.

I should also define a third element of value engineering, the VE Program Requirement Clause. This is a DoD-funded line item in a contract, requiring the con-

tractor to perform specified VE activities. It is most often used in CPFF and development contracts over \$1 million (where specifications are not firm and where hardware has not yet been produced in quantity) to reduce future production costs. A small portion of the savings generated may be shared with the contractor if VECP's result.

These terms and conditions are more clearly defined in section I, part 17 of the Armed Services Procurement Regulation.

DMJ. I think we can agree that despite accomplishments to date under the incentive sharing program, there is considerable room for improvement. Critics in both government and industry have leveled a number of charges at the program. Right or wrong, they argue that incentive sharing is a giveaway for work that has already been funded, that contractor response has been unenthusiastic, that the same reductions could be achieved without sharing by applying program clauses, that contractors withhold cost reduction ideas

GOOD BUSINESS OR GIVEAWAYS?



until they are covered by incentive clauses, and that government resistance to VECP's is so great that it's almost impossible to get one approved.

Let's examine these propositions one at a time. Mr. Fouch, is this a giveaway program?

FOUCH. The answer is an unqualified *No*. In fact, the reverse is true—this is a program to stretch scarce DoD resources, both in terms of manpower, money, and facilities, by utilizing the initiative and resourcefulness of defense contractors. Let's look at the facts of real life for a moment. The VE incentive clause normally used does not *require* a contractor to do anything. He can execute his contract and earn a fee within the framework of the contract without submitting a single VECP. Since developing effective VECP's requires an investment of his own money, no contractor could afford to develop many VECP's without a return on investment. To do so would reduce his profit and ultimately endanger his competitive position. For example, we have several contractors who have submitted over 100 VECP's apiece. Savings from these DoD exceed \$40

million. It is simply unrealistic to expect contractors to do such work "free," and that is why sharing of savings is necessary and proper.

DMJ. Let's look at the other side. Have VE incentive clauses meant "easy money" for industry, Mr. Keating?

KEATING. At Honeywell we have found that incentive sharing is precisely what the ASPR defines it to be: a business opportunity wherein a contractor may risk money and effort to stimulate the development of ideas which will reduce overall program cost. If his efforts are successful, he is awarded a share of the savings accruing to the government. If his efforts are unsuccessful, he receives nothing.

Honeywell submits an average of five VECP's per month. Maintaining this level of VE activity requires a sizable trained staff, plus considerable time and effort by management and professional personnel. Without the sharing arrangement, a contractor's motivation to submit cost reduction changes is stifled since these

would only reduce the amount of his contract sales, and therefore his profit.

DMJ. If incentive sharing represents a business opportunity as you say, Mr. Keating, then why hasn't contractor participation been greater?

KEATING. I believe this is largely a holdover from the early days of the program. When Defense Procurement Circular No. 11 launched the incentive sharing plan, VECP's appeared to be a very intriguing possibility for contractors. At the outset, many firms, Honeywell included, assumed the program would be received just as enthusiastically by the customers, with rapid processing of VECP's and few administrative complications. Like most companies, we learned this was not always the case. Honeywell's first dozen VECP's were rejected, most of them after prolonged delays.

It's not hard to understand why many contractors lost their enthusiasm after receiving this kind of treatment. Contractors truly want to satisfy customer wants, and when customers seemed to give VECP's a low priority, the contractor's inclination was to do likewise. We now realize that some of those early failures were due to lack of sound technical VECP preparation, adequate customer coordination, and good administration and followup. Since Honeywell management began giving this program the attention that its profit potential deserves, we have submitted over 180 VECP's. About 70 percent of them have been accepted. I think that generally we are now seeing a genuine change of attitude in the defense industry, from "Will VE sharing work?" to "How can we best make it work!"

DMJ. Mr. Fouch, is there any basis to contractor complaints about customer resistance to processing of VECP's?

FOUCH. I'm afraid this may have been true at first. Any new program which represents such a radical departure from the past practices requires a period of adjustment. New machinery must be created and perfected to process contractor submittals, and we must do something of a selling job on our own people to make certain they understand not only the "how" of incentive sharing, but also the "why." Our efforts in this direction are continuing, and I believe that the improvement in contractor attitudes that Mr. Keating mentions is matched by a rededication within DoD to make incentive sharing realize its potential.

Take processing time as an example. At the end of fiscal year 1967, 65 percent of the VECP's in process had been on hand over 60 days. By the end of fiscal year 1968, we had cut this 65 percent to 39 percent. We expect to further improve this performance with new configuration management directives recently issued.

KEATING. Let me add that faster VECP processing is doing a great deal to encourage our cost reduction activities. Once a cost improvement is refined and ready for implementation, any delay in processing the change represents a loss of savings to all concerned. Since many contracts containing incentive clauses are of short duration, fast implementation is especially critical. At Honeywell we have experienced a reduction in total government VECP response time from an average of 92 days in fiscal 1967 to an average of 70 days in fiscal 1968. In some cases, we have seen VECP's advanced in priority over noncritical ECP's. This kind of handling is beneficial to both industry and DoD.

DMJ. Mr. Keating, a number of contractors feel that DoD won't approve VECP's having a large dollar value. Does Honeywell's experience bear this out?

KEATING. We have nothing in our records to substantiate such a conclusion. I know of only one case where this excuse may be valid. Actually, I believe these claims arise from reluctance on the part of DoD personnel to approve high-dollar VECP's which require a sizable DoD investment in time or money before DoD benefits. This greatly increases the government's risk, and decisionmaking is naturally more conservative. Nevertheless, Honeywell has had three VECP's approved where total savings exceeded \$1 million, and several which exceeded \$100,000. Perhaps Mr. Fouch could comment on high value awards to industry as a whole.

FOUCH. Our statistics indicate that DoD can and does approve VECP's associated with large dollar savings. To do otherwise would be contrary to the basic objectives of the incentive sharing program. Last year nine VECP's with an estimated average value of over \$1 million were approved. Estimates on two of these exceeded \$4 million in total savings. As the program continues to gain momentum, I'm sure industry will see even more approvals of this sort. (Editor's note: See table I.)

TABLE I.—*Distribution of High-Dollar VECP's**
FY 1968

Dollar range	Number of approvals
100,000 to 249,999.....	55
250,000 to 499,999.....	33
500,000 to 749,999.....	9
750,000 to 999,999.....	7
1,000,000 to 1,999,999.....	5
2,000,000 to 2,999,999.....	2
3,000,000 to 3,999,999.....	0
4,000,000 and up.....	2

*Net total value prior to sharing.

Source: DoD VECP Report.

DMJ. Mr. Keating, isn't there some feeling among contractors that substantial incentive awards such as these may have an adverse effect on future negotiated fee rates?

KEATING. There is some undercurrent to this effect. I know our own people get a spongy feeling about it sometimes. The truth is, however, that we have not experienced such treatment. As long as negotiators have accurate data and a complete understanding of the benefits actually accruing to both parties, there should be no need to penalize the contractor by subsequent fee reductions. This matter does deserve attention, though, for such a practice—or the fear of it—can only motivate contractors to deemphasize VECPs.

FOUCH. Actually DoD policy is just the reverse. Under the weighted guidelines for negotiation, a contractor can be awarded more fee for past superior VE cost reduction performance. Contracting officers who reverse this policy could well end up costing DoD money, since, as Mr. Keating remarked, a contractor subjected to lower fees would simply tend to reduce his VECP effort.

DMJ. Mr. Fouch, let's return to the "giveaway" syndrome. Some people say that because a VE program requirement clause is funded by DoD, any sharing is an unearned bonus. Is this true?

FOUCH. Sharing is possible under the VE program requirement clause but it is much less frequent and when it does occur, is at a much lower percentage because the government has accrued greater financial risk. It is less frequent because VE program requirement clauses are primarily used in development to lower future production costs. Since the production baseline is not yet established, few, if any, of the VE proposals developed require a contract change—thus few, if any, are eligible for sharing.

The last part of your question is whether such sharing is unearned when it does occur. This question is too involved for a complete discussion of the pros and cons here. Let me try to simplify by saying that the consensus of a large number of people, the ASPR Subcommittee, which studied and developed such sharing, and the DoD ASPR Committee, which approved it after due deliberation, obviously is that such sharing, all factors considered, is warranted.

From a practical viewpoint, a contractor's total VE effort is probably larger than the funded VE program clause. Such sharing provides a motivation to submit VECPs regardless of origin-funded clause or independent contractor VE effort.

In one sense such sharing is similar to other incentives for cost and performance within the contract, except that the baseline for normal performance here is zero. We offer incentives of many kinds to get manage-

ment's attention. I don't see why VE program clauses should be different.

KEATING. The principal purpose of program clauses is to get ideas early. While the contractor is in the process of developing documentation, VE offers him the opportunity for developing a system which will compete with other system developments and which will have the lowest life cycle cost. Sharing during this phase of development is limited to where obsolete or excessive requirements are imposed by the development contract. This is certainly to both parties interest not to spend highly trained manpower and dollars working to unnecessary requirements.

As a development cycle nears its completion and documentation becomes firm and contractor work has been mutually satisfied, program clauses with small sharing provisions encourage the contractor to continue to develop worthwhile ideas. Since VE program requirement clauses normally fund proposal costs only, there is still a contractor risk associated with implementing them while there is still time for testing and before hard tooling is committed. Sharing here assures the contractor of a return on effort even if he doesn't produce the item, and, most important, assures the customer that customer savings' benefits start early in the procurement cycle. Most important, this reduces the tendency to withhold good ideas. Properly used, sharing under program clauses where customer approval is required to alter drawings or specifications, is the best way to motivate contractors to submit good ideas as early as possible.

DMJ. Some DoD personnel feel that we should use a VE program clause in production instead of the VE incentive clause, and thus get a higher share of the savings. Would you comment?

FOUCH. This may be possible and even desirable in a few selected cases but we simply don't have the resources to fund and monitor such activity on a wide scale. For example, only one out of every 10 contracts with a VE clause currently uses the program requirement clause. Furthermore, in fixed price situations the contractor would get all "Class II" savings which would greatly increase his share. In fact, he might get all the savings if only Class II changes resulted. (Editor's note: "Class II" changes are those changes which a contractor can implement without government agreement to a change in the contract.)

VE program requirement clauses and product improvement clauses have a common weak point—that a contractor doesn't have to achieve savings to get paid. He will normally invest better talent if he takes more risk. This is not a question of integrity, but a fact of managerial life.

This is also true in development, of course, but program clauses are used there because there is no

product configuration baseline to use for VE incentive clause purposes. In general we are probably better off to use the straight VE incentive clause whenever we can, since this conserves DoD resources.

KEATING. I agree. No one knows whether a VE study during a production contract will result in Class I or Class II changes, so use of the program requirement clause in production contracts of a fixed price type would need extra government control to insure DoD of a return on its investment. We prefer a straight VE incentive clause wherever possible since we feel we are in the best position to determine the amount of investment. Even if DoD knows this, money may not be available or could be used for other purposes.

DMJ. Some DoD personnel fear that VE incentives encourage industry personnel to "design stupid" and "build smart" in order to increase VECP income. Is this a legitimate fear?

KEATING. I question that this could or would be done in real life. To do this "on purpose" would require the collusion of many people. More important, this fear ignores the force of competition. No rational contractor will risk his competitive position and reputation for the sake of possible future windfall profits. The odds of getting a contract are tough enough—artificially raising the bidding price would simply make the odds tougher.

FOUCH. Let's remember that competition exists in many forms—in contract definition, in breakout and so forth. But in addition to the competition between contractors on a specific system or equipment, there is frequently additional competition in the DoD between alternative solutions for the same mission requirement. We can all name major programs canceled

because of this. What is less known is that competition of this type also frequently exists between smaller items of equipment. We must also remember that DoD is protected through government technical surveillance and review. These forces are formidable obstacles to such practice.

When one weighs the legitimate potential benefits versus the slight probability of small losses from isolated unethical practices, letting such fears dominate is pennywise and pound foolish.

DMJ. Mr. Fouch, perhaps at this point we should take stock of the overall VE Incentive Program. Where do we stand today?

FOUCH. Since fiscal year 1965, over 3,400 VECP's worth an estimated \$150 million to DoD have been approved. Present progress is encouraging. Estimated savings to DoD in fiscal year 1968 reached \$51.8 million. This is a 33-percent increase over fiscal year 67. The number of VECP's approved increased 23 percent, while DoD processing time improved significantly. These statistics are buttressed by informal reports of growing top management interest in the defense industry.

However, as I've indicated, this progress is relative. There is no doubt that potential is far greater than current achievements. One independent survey estimated at *immediate* potential for savings of \$200 million annually. An analysis of current performance shows wide variation between contractors, within divisions of the same contractor, between the military services, and between major programs in the services. A look at the DoD programs with the most VECP approvals is most notable for the many major programs *not* in the list. (Editor's note: See table II.)

TABLE II.—*Top DoD Program Contributors to Fiscal Year 1968 High-Dollar VECP Savings*

Program	Service	Number of approvals	Estimated dollar value to DoD
1. Minuteman.....	Air Force.....	1	5. 924
2. M219E1 fuze.....	Army.....	10	5. 814
3. GAU-2B/A aircraft machinegun.....	do.....	2	3. 190
4. AGM-69A missile.....	Air Force.....	5	1. 825
5. 4.2 M329A1 Project MPTS.....	Army.....	1	1. 652
6. J57, J75, TF33 engine.....	Air Force.....	9	1. 641
7. M557 PD fuze.....	Army.....	1	1. 411
8. TD 660/B multiplex.....	do.....	5	. 800
9. SUU-11 A/A aircraft machinegun pod.....	do.....	2	. 639
10. BMEWS.....	Air Force.....	1	. 631
11. M 48A tank.....	Army.....	3	. 629
12. C-5A.....	Air Force.....	4	. 600
13. FMU-541B fuze.....	do.....	2	. 585
14. MK 32 warhead.....	Navy.....	1	. 584

DMJ. Mr. Fouch, what is DoD doing to increase the program's acceptance and realize this potential?

FOUCH. Fundamentally, we have three major tasks:

1. To educate and motivate both DoD and industry personnel.

2. To improve VECP processing.

3. To refine and improve ASPR as indicated.

We have activity in all these areas. Twenty-four Executive Value Engineering Seminars are being held this year for DoD personnel in various geographic locations in the U.S.A., in addition to the normal VE training. The Army Materiel Command, the Navy, and the Air Force Systems Command have set goals to increase the number of VECP's reviewed. VECP processing has been improved, and new configuration management directives will improve it further. ASPR improvements are under consideration. The Services and DSA are active in many additional ways. We are informing contractors of progress and opportunities by letter, personal visits, and seminars.

DMJ. Mr. Keating, what is industry doing in this regard?

KEATING. Many corporations are now individually taking active steps to strengthen their VE efforts and increase their participation in the VECP program. The AOA is conducting a study of the more successful contractors to help identify key ingredients to successful programs. The Society of American Value Engineers and other organizations are collaborating with DCAS and the Services in holding executive seminars in various cities to inform defense contractors on the nature of the VE opportunity. About the only area where industry is not active collectively is at the top management level. This may come shortly.

DMJ. Mr. Keating, what specifically can an individual company do to participate more actively in this program?

KEATING. Involve management at all levels. Begin negotiating VE Contract clauses which provide the greatest degree of incentive to both parties. Educate employees in VE techniques and contract incentives. Set specific goals and have a scheduled study program for generating VECP's. Make sure everybody, marketing, contract, engineering, production, accounting, procurement and other specialists are on the VE team, and know and execute their respective responsibilities. Develop complete sound and technical proposals—and very important, market them with the same skill and emphasis given other proposals of equivalent profit potential. The contractor checklist published in DoD Handbook 5010.8, *Value Engineering*, provides useful

guidelines, and we have developed our own 10-point program at Honeywell. (Editor's note: See checklist on p. 22.)

DMJ. Mr. Fouch, what specifically would you encourage DoD Procurement Contracting officers and Program managers to do?

FOUCH. Recognize that VE incentives are a new way to stretch Government resources, and that a total cost perspective is necessary. Recognize that DoD will generally benefit most when contractors submit VECP's in large numbers. This means motivating them through fair sharing and equitable and prompt handling of contractor submittals. Take the DoD VE Incentive Checklist and act accordingly. (Editor's note: See checklist on p. 22.)

DMJ. What is a good sharing percentage?

FOUCH. One that gives the contractor sufficient incentive while still realizing significant benefit to DoD. Both sides must realize that 80 or 90 percent of nothing is still nothing. Both parties lose if sharing is imbalanced. The intent of the ASPR VE Subcommittee was that 50-percent instant sharing, with royalty and collateral provisions would be in practically all contracts.

When DoD PCO's and Program managers fail to motivate contractors by proper sharing of savings, they have cost the Government and the taxpayer their share of the savings and benefits we know contractors could generate. In short, we're getting less defense for our tax dollar.

KEATING.—Let's remember that VE sharing is an *incentive* program for both parties. While each participant must protect his vested interest, the result must be a sharing agreement which provides incentive to both parties. Too high a share for the contractor will simply mean that the customer agency will have no motive to approve the change. Too low a contractor share on any given contract will have the effect of turning his VE efforts to other contracts, or reduce his effort to "lip-service." DoD loses when this happens.

A 50-percent sharing percentage seems to me to be a minimum fair contractor share since he bears the greatest risk. If the base to which he can apply this share is questionable and contracts are of short duration, a higher share may be required to stimulate his efforts. Royalty sharing percentages and time periods are dependent upon the degree of certainty of future procurement periods. Firm, projected production over an extended period can result in a lower sharing arrangement being acceptable. The converse requires larger percentages and time periods.

DMJ. One final question, gentlemen. What does the future hold for VE incentives?

KEATING. I get a definite feeling that the program is on the move. Several contractors have proven that it works if you work it intelligently and conscientiously. Profit is being made by industry and audited savings of a respectable magnitude are being accrued by DoD. Current savings represent only a small portion of potential savings if all contractors participated more actively. If the same serious effort, now being displayed, is continued and problems are systematically solved, I foresee VE savings having an increasing effect on our Nation's economies.

FOUCH. We are seeing signs of considerable progress now. We have proven that present VE incentives can be mutually beneficial to DoD and industry. Several companies have demonstrated that VECP's can be sold to DoD in large quantities for significant dollar amounts. DoD management will increasingly recognize that VE incentives are a new means of stretching DoD resources, and that fair sharing in VE incentives supports a total cost viewpoint—a view already recognized in such programs as Total Package Procurement, Multi-year Contracting, Life Cycle Costing, and Integrated Logistic Support. Industry management will recognize that VECP's are a worthwhile "new product line" when properly managed, and act accordingly. The future could be very bright if management understands and aggressively respond to the challenge.

DMJ Summary

It is obvious that many key DoD and industry personnel have supported the DoD VE Contract Incentive Program. It is equally obvious that large numbers of personnel in both DoD and industry have resisted the program through lack of a full understanding of the mutual benefits of the program. This seems particularly strange when one recognizes the popularity of a total cost approach in DoD—and that VE contract incentives are consistent with such a total cost view. Yet many well-intentioned personnel on both sides persist in suboptimizing their actions on individual VECP's or contracts. The statistics cited by Mr. Fouch and Mr. Keating leave little doubt that the opportunity for mutual benefits is real. The challenge then is simply whether Government and DoD operating personnel are farsighted enough to capitalize on the opportunity. The DMJ appreciates the candor of Mr. Keating and Mr. Fouch in reviewing their experiences and philosophy on Value Engineering Incentive Clauses.

CONTRACTOR'S CHECKLIST FOR EFFECTIVE VECP'S

1. Do you set company or division goals for VECP income?
2. Are VECP goals established for line department and program managers?
3. Does top management review VECP income and approve VE operating goals and budgets?
4. Does company top management meet with key customer personnel to agree on VECP goals and processing on major contracts and programs?
5. Do personnel, such as marketing, work on the "team," and do they receive credit for VECP's approved, or are they "penalized" due to reduced credit for reduced contract price?
6. Do your negotiators understand VE in ASPR? Do you request and negotiate for fair terms?
7. Do you place VE sharing provisions in your subcontracts?
8. Is VECP income identified separately by accounting so that (1) Renegotiation Board review is eased, and (2) top management can recognize VE's contribution?
9. Do you assign resources to the development of specific VECP's?
10. Do you operate such that you minimize time to (1) develop a VECP, and (2) obtain internal company approval prior to submittal to the Government?
11. Do you conduct formal VE workshops to expand your in-house capabilities?

DOD PROGRAM MANAGER'S VECP CHECKLIST

1. Have you set program goals for VECP's (number of VECP's received or dollars saved)?
2. Are these goals apportioned to programs and contractors?
3. Do you periodically review progress and savings from VECP's in your programs?
4. Have you and other key personnel communicated your desire to receive sound VECP's?
5. Do your procurement officers give fair VE ASPR terms and encourage prime contractors to extend sharing to subcontractors?
6. Have you established procedures for routinely but promptly processing contractor VECP's?
7. Have DoD personnel on your program been briefed on the benefits of VECP's?
8. Have you checked your major contractors' programs against the contractor's checklist?



The author (at left end of table) "practices what he preaches" by regularly underscoring to his staff the importance of top level emphasis as a cost reduction stimulus.

MOTIVATION IN COST REDUCTION

IT HAS BEEN a banner year for the Army's Cost Reduction Program.

The success of a cost reduction program should justifiably be measured in dollars, and examination of the fiscal year 1968 totals reveals a savings of \$342.7 million—or 146 percent of the established savings goal. Savings of \$632.6 million also were reported to the Secretary of Defense, constituting 129 percent of the 3-year-old goal (fiscal years 1968-70).

Those figures represent the efforts of thousands of men and women who have been looking for better ways to do their jobs. They also represent the cost reduction specialists who motivate people to find the means to effect savings, help to identify the savings that have

been accomplished, and insure that the savings are reported. Finally, they represent the audit personnel who assist in identifying savings, determine that what has been reported is a creditable cost reduction, and ascertain that the amounts reported are accurate.

All of these people have performed most competently since the inception of the Cost Reduction Program. But their outstanding accomplishments in the fiscal year 1968 program were especially gratifying and significant.

There was a combination of many contributing factors affecting personnel concerned with all areas of cost reduction: those responsible for management improvement ideas, the administrators and the auditors. But the principal and oftentimes intangible factor has been the integration of both old and new management attitudes and techniques that is resulting in the adoption and dissemination of more—and more productive—cost reduction ideas.

By LT. GEN. JEAN E. ENGLER
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Motivation of the Cost Reducers

"Cost Reducers" come from every echelon of the Army, from the private and civilian laborer to the general officer and supergrade. Therefore, motivational techniques are diversified by necessity in an attempt to reach every member of the Army team.

A fundamental step is to make the program known to the widest possible audience. Army media are giving excellent coverage to the program, and extensive publicity efforts are gaining frequent attention from civilian media. In addition, several commands are initiating special publicity programs. A good example was the Tank-Automotive Command's (a subordinate command of the Army Materiel Command) special cost reduction display at their 1968 Armed Forces Day open house, where souvenir "stretch" dollars were distributed.

Education is absolutely essential in this field, and the Army maintains an active cost reduction-management improvement training program. The U.S. Continental Army Command (CONARC) includes cost reduction orientation in most of its schools as, for example, the Infantry Officer Basic and Advanced courses. "Middle" management personnel attending the Army Management School at Fort Belvoir, Va., are given a special cost reduction briefing by the Chief of the Army Cost Reduction and Management Improvement Division, Headquarters, Department of the Army. Seminars, conferences, forums and workshops are held by many of the major commands.

One of the program's principal motivational devices is formal recognition of outstanding achievement of both individuals and organizations. Recognition of individual contributors to the program has been implemented at all levels of command for some time. An innovation which created intense interest this year was the establishment of an Outstanding Unit Award.

The idea originated in the Department of Defense in connection with the annual DoD Awards Ceremony. In order to nominate a unit to DoD, the Army invited nominations of subordinate units from each of the major commands. After selection of The Infantry Center, Fort Benning, Ga., as the Army's 1968 nominee for the DoD award, six runner-up units were presented with Outstanding Unit Commendation Certificates signed by the Chief of Staff.

Recognition also was accorded to the major commands, agencies, and staff elements which exceeded DA-assigned cost reduction goals. Several commands held ceremonies for the presentation of awards. In addition to awards for the internal program, the Army Materiel Command held a special ceremony for the presentation of awards to Army contractors.

Contractor personnel received a goodly share of our cost reduction motivational efforts, particularly in the area of Value Engineering. In an effort to insure prompt

and constructive command action on Value Engineering Change Proposals (VECP's), the Army now requires that a VECP be given final disposition within 30 days of its receipt. If this does not appear feasible, the VECP must be acknowledged, and the contractor given reason for the delay in its processing and the date of its intended resolution. Additionally, it is required that contractors who submit VECP's be given reason for the delay in its processing, and the date of its intended resolution. It also is required that contractors who submit VECP's be given full recognition for their contribution.

DA monitors ADP lists of contracts containing VE incentive clauses by activity, and more and more emphasis has been placed on their inclusion wherever applicable. Gen. Frank S. Besson, Jr., Commanding General of the Army Materiel Command (AMC), has shown his interest by requesting that his major commanders write their contractors and invite greater participation in the VE program.

The importance of the VE program has been emphasized by the personal visits of top Army management to top contractor management. The Army also is active in contractor VE seminars conducted by Defense Contract Administration Service Regions. Army personnel promote the VE program at these seminars by participating as speakers and in panel discussions.

These VE motivational efforts resulted in \$27 million VECP's in fiscal year 1968—more than in all other DoD elements combined. Many of these proposals were reported in the fiscal year 1968 Cost Reduction Report; most of the remainder will be reported in fiscal year 1969.

The Cost Reduction Program has challenged the initiative of both Government and industry to find new and better ways of managing assets. It has required detailed planning, as does every other managerial function, and has demonstrated that efforts to reduce costs must be treated as an integral part of day-to-day management, rather than a separate and distinct process. To achieve this ideal, personnel constantly must be made aware of the importance placed on the program. Top management, therefore, attempts to exhibit continuous encouragement and supervision. While many excellent management actions will be taken regardless of cost reduction emphasis, insistence on reporting, the challenge of goals, and audit validation lead to improvements which would not have been made otherwise.

Motivation from Top Management

A dramatic example of motivational influence exerted by top level management was observed last year in one major Army area which had not achieved its cost reduction goal for the 2 previous years.

In the second quarter of fiscal year 1968, the Commanding General wrote a letter to his major com-

manders endorsing support of the program and setting forth guidance where particular emphasis should be placed on cost reduction. By the end of the fourth quarter, every installation and activity had exceeded its goals; 207 percent of that major Army area's fiscal year 1968 goal and 327 percent of its 3-year effect goal had been reached.

The performance is even more remarkable when it is noted that as late as the end of the third quarter, only 34 percent of the major Army area's goal had been reached. The efficacy of motivation in this success is obvious. The way it was achieved is worthy of examination.

Initially, inquiries were made to other commands concerning how their savings were achieved. Similar experiences revealed that accomplishments were in direct proportion to the amount of time spent on the program. Visits were made by program personnel to the various installations to discuss their individual cost reduction problems. A seminar was held, and there were meetings with audit personnel in attendance. As a result, performance improved, and the invalidation rate dropped.

Staff office and activity chiefs were appointed as area monitors and became directly involved in the program. Supervisors were required to become sufficiently knowledgeable to be able to recognize what was reportable and what constituted essential supporting data. "Cross-feeding" suddenly became very popular, and validated savings promptly were circulated to other installations for possible use. Supervisors were reminded of their management training in such areas as Work Simplification, Work Measurement, and Time and Cost Studies; that these techniques should be used in the decisionmaking process; and that when these techniques result in savings, the savings must be reported. "Feedback" was furnished promptly, and considerable effort was given to evaluation of the reports and advisement of necessary changes.

The organization's Cost Reduction Program was established on a sound basis in spite of the crash program that instituted it. At the end of the first quarter of fiscal year 1969, 28 percent of its goal was reported. Every installation but one had achieved savings of 24 percent or better; and rather than just a few large savings, 74 actions were reported—evidence of a healthy program.

Personal contact and improved communications have been a chief vehicle in solving many problems. After a DA team of cost reduction and audit personnel visited U.S. Army, Europe (USAREUR) to assist in solving reporting and validation problems, USAREUR made an outstanding contribution to the program in fiscal year 1968 by attaining 190 percent and 273 percent of its current-year and 3-year goals. The U.S. Army, Pacific (USARPAC) and other commands also have

used this technique very effectively with their subordinate units.

All of the above philosophies and methods have been instituted Army-wide. Other adopted methods include regularly scheduled meetings of area monitors to discuss plans, new approaches, and achievement of goals; the use of reporting checklists to reduce audit invalidations due to misinterpretation of regulations and poor report preparation; and periodic briefings to top management personnel about the program's progress.

Selective reporting has been instituted by the U.S. Army, Vietnam (USARV). Because of the urgency of the Southeast Asia situation, USARV has not been required to report formally under the program. Backed by strong emphasis on cost reduction by Gen. Dwight E. Beach, then the USARPAC Commander, coordinators from his headquarters worked with USARV in isolating several major projects having high savings potential. They also worked with local Army commanders to get the savings properly documented, computed, and reported. One action alone, involving landing mats for airstrips, saved over \$29 million during fiscal years 1968-69.

At headquarters, one objective is to assure that the total staff is involved in the identification of potential savings actions. The budgeting-programming activity provides an excellent example. PEMA budget activities, Program/Budget Decisions, and reprogramming actions now are being reviewed to determine if they qualify for cost reduction reporting and to encourage participation in the program by budget development officials.

Another "personal touch" is administered by AMC on a monthly basis in the form of an informal Cost Reduction Newsletter. The letter dispenses specific praise and an occasional general criticism and serves to keep the program on a friendly basis.

The innovation of a "Report Card" was one of AMC's most recent ventures. Field personnel were invited to evaluate AMC Headquarter's cost reduction management personnel concerning the type and quality of support they were giving to the field. Everyone was evaluated on a name basis and given a numerical rating. A good indication of areas for improvement was obtained, and the field most likely will be given better and more understanding support in the future as a result.

An unrealistic goal potentially is demoralizing. With this in mind, AMC, which bears the responsibility for the greatest percentage of the Army's Cost Reduction goal, has developed a regression technique for the assignment of goals in four of their largest areas.

The method considers savings as a function of an appropriate independent factor. For example, the factor for Secondary Items is projected Stock Fund and PEMA secondary sales. It is assumed that as the in-

dependent factor increases, the potential for savings increases. After verifying this assumption with historical data, a formula computation for the goals is made. By this method, AMC can determine a range of values within which a goal may be established. More equitable and challenging goals now can be developed, and the tensions associated with the assignment of unreasonable or unattainable goals will be reduced.

The Army Audit Agency

A new era in program-audit relations has evolved as a result of the intensified efforts of the Army Audit Agency. At the end of the last fiscal year, Audit headquarters received several letters attributing a good portion of the year's success to the audit assistance given by the AAA. This was largely due to the letter issued in March by Maj. Gen. H. G. Sparrow, Chief of the U.S. Army Audit Agency, giving the following advice to his auditors:

"In performing the validation-of-savings mission, the auditor works between two millstones: one is the pressure from claimants to approve their claims; the other is the knowledge that approved claims which are subsequently declared invalid will redound to the discredit of the Army. In this strongly contested game, the auditor is the referee—but he does not make the rules. It is thus vital that his review be objective, fair, and constructive.

"Recognizing the problems attendant upon the Cost Reduction Program, I would urge the following:

"a. Know the rules. Study carefully the basic directives and regulations, so that your conclusions may be correct.

"b. Keep a positive attitude. As a member of the Army team, you have a duty to help the Army meet its assigned goals in any legitimate way you can.

"c. Recognize the problems of the Cost Reduction Monitors, who often find their task both frustrating and discouraging. Share with them your knowledge, including the contents of the Audit Guide; add your ingenuity to theirs in finding ways to establish valid savings; encourage them to seek your counsel early in the game."

Emphasis on the positive aspects of the auditors' role in the Cost Reduction Program has made a remarkable contribution. Audit personnel have worked more closely with program personnel, helping to develop the appropriate methods of computing savings. More suggestions are being made to identify areas where possible cost reductions exist. In some instances, auditors are aware of cost reduction actions at one installation which may, with or without revision, be applicable at another and have taken the initiative in bringing it to the attention of the second installation.

In summary, the Army has achieved a well-rounded motivational program for the development of greater cost reduction—from training through evaluation. Although the need for improvement continues, the cost reduction team now has a program that is producing and reporting savings which are in proportion to our capabilities. □

ANTIDOTE FOR SKEPTICISM

"In June of this year, a lady who lives in a small town nearby wrote the President concerning what she called the 'appalling waste' at Fort Riley," began Brigadier General Albert E. Hunter, Director of Plans, Office of the Deputy Chief of Staff for Logistics, Department of the Army, as he spoke to the military personnel and civilians attending the U.S. Continental Army Command Cost Reduction Seminar hosted by Fort Riley not long ago in Junction City, Kans.

He continued, "She stated in her letter that the Army should not be permitted—and I quote—'To destroy an incredible amount of usable material and food . . .' She went on to say: 'I realize a change of disposal methods would shake the armed forces more than a continental attack; still, a word from the Commander-in-Chief should do it.' End of quote.

"Naturally this letter generated an investigation to determine what waste this lady was referring to. We replied to her and indicated we knew of no 'appalling waste' at Fort Riley. A second letter from her had this interesting P.S. 'I have personally observed very little of

this waste but the fact is so generally accepted that your reaction surprised me.' We never were able to find out exactly what bothered her. But the key point is that she, at least, was, and probably still is, firmly convinced that, as she wrote, 'considerable waste is inevitable in the operation of so large an organization as the Army.'

"I know I need not belabor the point that this lady is terribly misinformed as far as the inevitability of waste is concerned. But what can we do to convince her, and many other Americans, in and out of uniform, that waste is not inevitable in the Army? We can convince many if we advertise that we have an aggressive and highly successful program of cost reduction."

He went on to say that those attending the meeting were well aware of the Army's Cost Reduction Program but too many Americans were not aware of the program. "If each of us, by our complete dedication and enthusiasm for cost reduction, can spread the gospel and make believers out of the skeptics, we may even convince the lady who wrote the President about Fort Riley."

The Past and Future in

COST PLUS AWARD FEE CONTRACTING

PERFORMANCE EFFECTIVENESS also means cost reduction. A relatively new management tool in this area is the Cost Plus Award Fee contract.

A subjective incentive system based upon after-the-fact evaluation of overall performance effectiveness offers important, inherent advantages over the alternatives of using CPFF with no incentives or immeasurable CPIF incentives. The results to date of the use of the CPAF contract have been almost startling because, despite our probing and looking for deficiencies, we find that none of the forecasted consequences have developed. The CPAF contracts have provided stronger disciplines on both sides, improved communications, and flexibility in administration.

First Explored in Early Sixties

Several Department of Defense officials and NASA officials were thinking independently about award fee contracts during 1960 and 1961. Assistant Secretary of Defense Thomas D. Morris discussed the idea to use a Cost Plus Award Fee (CPAF) contract in cost-reimbursement situations in an address at the Joint Industry-Defense Department Symposium of the NSIA on June 15, 1961. These remarks were the first public reference to award fees. Prof. Frederick Scherer suggested in the Harvard Weapons Acquisition Research Project in February 1961 that the Cost Plus Award

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Fee contract type be considered. When Robert Charles first came to NASA, before his appointment as Assistant Secretary of the Air Force, he recommended that the award fee concept should be used when realistic and definite yardsticks are impossible to develop. Mr. Charles cautioned that while this type of judgmental incentive is far from ideal, it is infinitely better than no incentive in many CPFF situations. He went on to say that even if there are some abuses, this is better than having no cost reduction incentives—you do not do away with a traffic system simply because someone runs through a red light. Assistant Secretary of the Navy Barry Shillito and Assistant Secretary of the Army Robert A. Brooks have for some time discussed the need to perfect our techniques and procedures for the most appropriate use of subjective cost effectiveness incentives. In the earliest consideration of CPAF, Harold Finger, NASA's Associate Administrator for Organization and Management, recommended this new contracting concept to Navy officials and described NASA's first experience with CPAF negotiation and planning. Thus, DoD and NASA officials have a background of extensive experience with the CPAF procedures.

Now There Are Hundreds

The Navy and NASA each negotiated their first CPAF contracts during 1962. Since then, there have been a few problems and a few mistakes; however, there have also been several effective innovations, and the new contract type has received support from a broad spectrum of the aerospace and support services contractors. The Government now has more than 300 CPAF contracts valued at \$4.1 billion. Seventy-six contractors are engaged in CPAF contracting efforts with NASA. The Navy has experience with 99 CPAF contracts valued at over \$2 billion, and now has 43 active CPAF contracts valued at \$1.7 billion. Both the Army and the Air Force also are utilizing the CPAF type more extensively. We predict many new applications for CPAF contracts. At the same time, *we caution against too much popularity for the CPAF contract, and we caution against the misapplication of the contract type or the concept behind it.*

Fee Setting System Carefully Drawn

The concept of the CPAF contract has remained relatively unchanged during the last 5 years. The CPAF contract is a cost-reimbursement type of contract which provides that the contractor's variable fee will be determined subjectively by designated, high-level Government personnel on the basis of periodic, after-the-fact evaluations of the contractor's performance. The contract contains a base fee and provision for the fee to be adjusted upward on the basis of the contractor's performance, evaluated after-the-fact in accordance with criteria set forth in the contract. The award fee determination is based on recommendations of an Award Fee Evaluation Board, and is the subject of special

checks and balances which provide procedural safeguards protecting the contractor from arbitrary or capricious evaluations, but the award fee is not subject to the conventional "Disputes" clause.

NASA's Procurement Regulation coverage of CPAF contracts is contained in NASA PR 3.405-6, while the DoD coverage is contained in ASPR 3-405.5. NASA's regulatory coverage of the CPAF type contract was made effective in July 1965. The ASPR Committee had approved an extensive service test of the contract type during 1965-68, prior to its recent acceptance as an approved contract type in the ASPR.

Defense-NASA Practices Essentially Alike

Certain details of the ASPR coverage differ from the CPAF coverage provided by NASA; however, there is no substantive difference in the approaches, and it is expected that the application of the CPAF concept and the general procedures will be essentially the same in practice. Of course, each CPAF evaluation plan includes details which are specifically selected to fit the particular requirements on a case-by-case basis.

One of the regulatory differences is the ASPR limitation on the amount of the base fee. ASPR states that the amount of the base fee shall not exceed 3 percent of the estimated cost of the contract, exclusive of the base fee; the NASA PR does not apply any limitation to the amount of the base fee. In actual practice, however, approximately 87 percent of NASA's CPAF contracts contain base fees that are below 3 percent, and about 20 percent of the contracts have a zero base fee. Thus, NASA and DoD practices will be essentially the same in the base fee area.

Both NASA and DoD emphasize that the CPAF contract is appropriate for the application of incentives where finite measurements of performance are not possible, and both emphasize that the contract type shall not be used merely as an administrative technique to avoid Cost Plus Fixed Fee (CPFF) contracts when the criteria for CPFF apply.

Applied Generally to Support Services

In the past, the CPAF contract has been used in most cases for support services. The descriptions of typical CPAF work in NASA have included: operation and maintenance of wind tunnels, technical services, stage management and engineering support, scientific and engineering support for space sciences laboratory, lunar orbiter photography, computer programing support services, logistical and technical information services, electronic instrumentation, launch support, manned space flight communication network support, and radiological services. Descriptions of the CPAF work in DoD have included: engineering and programing for the operation of a laboratory, operational computer program services, data acquisition and reduction, operation of instrumentation systems, maintenance and operation of facilities, off-site base and logistics sup-

port, maintenance and operation of down-range tracking network, design-production-reliability engineering services, ship design, environmental testing services, systems engineering-test, hardware integration, and Government-owned/contractor-operated plant management.

Preferable to CPFF

Qualitative reviews and audits of the effectiveness of CPAF contracts have been conducted periodically during the past 5 years. We have found both efficiencies and some isolated deficiencies in procurement and in contract administration. Overall, the findings have supported conclusions that the CPAF contracts do provide better direction to contractor motivation and are preferable to CPFF when appropriately applied. The qualitative reviews have included on-site examinations of CPAF operations and interviews with Government and contractor personnel involved in operations and administration. We actually conducted one in-depth review of CPAF operations at the bottom of the Nike-X antimissile launching silos on Kwajalein Island—and the review range has extended from launch support activities at Cape Kennedy to the various technical laboratories, and to the flight deck and cockpit of the B-70 airplane.

Some Deficiencies Found

The reviews and audits have found isolated cases involving the following deficiencies: (i) Award fee range too narrow for effective motivation; (ii) use of a target fee as a base fee with a narrow fee swing each side of target, similar to a CPIF structure. Earlier studies in 1964 and 1965 concluded that the presence of a target fee or fee swing in a subjective cost-reimbursement type contract tends to promote a scoring bias; (iii) a very few cases where the contract type has been improperly used and where CPFF or CPIF would have been more appropriate for the particular contracting situations; (iv) use of "standardized" criteria to define performance where the criteria describes *input* to the contract effort rather than *output*; (v) award fee plans which determine award fee earnings on a semiannual or annual basis. Studies have found that communication is improved and motivation is increased when interim reviews of performance are conducted monthly and when written evaluations and fee determinations are completed quarterly; (vi) overly complex administrative plans have resulted in broad coverage of too many details with emphasis on none; administrative effort has been too costly for both the Government and the contractor; and (vii) a requirement for more consistent identification of problems and accomplishments through evaluation reporting procedures which highlight the sources of problems and accomplishments and which include performance and cost effectiveness indicators.

The few deficiencies we found in earlier reviews did

not represent insurmountable problems, and these are being resolved as additional operating units receive more training and experience with CPAF contracts.

Guidance and Procedures

NASA's Cost Plus Award Fee Contracting Guide was printed and released through the Government Printing Office during August 1967. NASA's 116-page CPAF Contracting Guide (NHB 5104.4) is available from the Government Printing Office. The rating and evaluation plans in the new Guide are considered to answer the early criticisms of CPAF contracting. The CPAF Guide was structured so that it can be used with little or no change by other Government Departments and Agencies. Updated procedures are now being considered in the drafting of a potential NASA/DoD Incentive Contracting Guide which may be issued as a joint effort during 1969. The current guidelines have been used and distributed in DoD's Executive Refresher Course for procurement personnel, and the procedures have assisted in the orderly expansion of the CPAF effort. It must be remembered, however, that procedures, guidelines, and directives do not, of themselves, guarantee that incorrect and wasteful practices will be avoided unless supplemented by effective, independent review. All review programs should be geared to assist in identifying problems and suggesting CPAF incentive contracting improvements.

Looking Ahead

In the future, we will need to continue to recognize that reports and administrative data can be obtained at too high a price. The CPAF system of administration will have to be concerned solely with work output, not input, and the fee determination should be based on assessment of results rather than methods. We should be more concerned with what is accomplished than how it is accomplished. Looking ahead, we will still be concerned with Cost, Time, and Quality. Our CPAF criteria will cover General Management, Operations and Technical Management, and Business Management; however, our greatest challenge will be the selection of contract type. The CPAF should not be used if the benefits expected are insufficient to warrant the administrative effort, although good CPAF administration does not need to be more expensive than loose CPFF administration—good CPAF administration can be directed toward essential elements. This means a redirection of broad CPFF effort toward the few significant areas that determine output and program effectiveness. There is a great hope that we can understand and effectively utilize both the contractual and extracontractual motivating influences of the CPAF contract.

We look forward to realizing the full potential for the CPAF contract. It can be a strong management tool for cost reduction and performance effectiveness. □

PHYSICAL DISTRIBUTION—

A New Concept of Critical Importance to Government Procurement when Priorities Escalate

AS RECENTLY as 1950 the term physical distribution was rarely used in business, government, or academic circles. Today, integrated physical distribution has emerged as one of the most potent as well as provocative new aspects of commercial administrative control. This brief article is directed to two subjects: (1) a review of developments serving as catalysis to the emerging field of physical distribution and (2) a commentary concerning current trends in commercial management of physical distribution in relation to ways for achieving improved business-government procurement relations.

The Emergence of a New Concept

Businessmen have long been plagued by the fact that almost any product spends much more time in the process of physical distribution than it does in the manufacturing process. During the course of the 20th century this Nation's capability to mass produce goods has far outstripped our ability to efficiently move them to the marketplace. The typical situation is for products of all sorts and shapes to flow smoothly off highly mechanized production lines only to move into the chaotic world of distribution and "sputter" along.

Between origin—the manufacturing plant—and ultimate destination—use location—a great deal happens in terms of physical distribution that costs a huge

amount of money. Merchandise is handled, rehandled and then handled some more—often some 20 or more times. Goods are tossed, dropped, shoved and generally banged about. They are stored in a number of different places and under a wide variety of different environmental conditions. Between periods of storage the goods are transported, retransported and transported again. Generally, the one thing we can say for sure is that the item is put to the most severe test of endurance. And, if it fails to pass in usable condition, the blame is placed on a convenient scapegoat, such as, protective packaging. We then develop a stronger carton which can endure. Perhaps one of the greatest marvels of mass distribution in the United States is the fact that merchandise does arrive in usable condition at prices buyers are able to afford.

While the above anecdote is perhaps extreme, businessmen have come to realize that physical distribution costs a great deal. Depending upon industry and firm, total expenditure may range between 5 and 50 percent of gross sales. A safe estimate is that the total cost of physical distribution in the commercial sector of this nation now exceeds \$150 billion a year or approximately 20 percent of gross national product. These cost estimates do not include government expenditure for logistical support of domestic, foreign and military operations. It is little wonder that physical distribution has been referred to as "The Last Frontier for Significant Cost Reduction." The opportunities are many because so little has been done thus far.

This general physiocratic bias which has placed greatest emphasis upon manufacturing at the expense of the distribution process cannot be attributed to a failure on the part of businessmen to appreciate the importance and complexity of physical distribution. A more realistic appraisal is that until recently there was no reason to believe that an overall attack on physical distribution activities would result in significantly better performance or worthwhile economies. In the following paragraphs of this section, three recent developments offering a foundation for improved physical

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"Unlike the businessmen who strive to do a little bit better each year, the critical nature of government performance requires that a great deal be done better with each passing year."

distribution performance are briefly reviewed. The final paragraphs of this section present a statement or synthesis of the current state of development of the integrated concept of physical distribution control.

Maturity of the Computer Age

Perhaps the greatest single development which has spurred improvement in physical distribution has been the rapid maturity in computers. Although the first computer was not perfected until 1944, and as recently as 1950 computers remained a novelty, today, we are "knee deep" in the computer age.

The computer offers two significant areas for application in physical distribution. First, a capability is now available to assist management in the design of practical and improved physical distribution systems on an experimental basis. Alternative system designs or simulations can be tested without costly disruption of business operations. For example, computer applications are available to determine the most profitable number and location of warehouses, to evaluate the best transport alternatives and to establish proper inventory control standards.

The second significant contribution of the computer is that it offers a new type of information technology to assist managerial control of geographically dispersed operations. The geography of physical distribution operations creates a requirement to rapidly collect, evaluate, and disseminate information. Third generation computers coupled with data transmission devices provide a mechanism capable of assisting management in handling millions of operational details in an orderly and systematic manner. Decisions can be made on the basis of total system information displayed on a series of current status reports. With records maintained on a centralized computer, management can look forward to knowing critical factors concerning today's operation no later than tomorrow. This speed of communicating information necessary to make decisions in time to have an affect on results is extremely important. Too often the identification of a problem

occurs after the point in time where any change will have a bearing on the outcome. Compacting time is a very real benefit.

While admittedly a significant "applications" gap exists between computer capability and systems development, the important new horizon is that management can, for the first time, look forward to exploiting a "here today" technology. There is reason to believe a far better job can be done.

The Advent of Systems Logic

A second major development is the recent advent of systems technology. The term *system* is widely bandied about without too much regard for what it technically connotes. In most cases use of the term system is not incorrect, rather, it is just not complete nor illustrative of the full power and potential of the capabilities in the concept.

The systems concept provides a rigorous methodology for conception and testing of alternative physical distribution configurations. The systems concept provides a logic for treating and integrating corporate activity centers required to accomplish specific goals. Systems technology stresses that it is the performance of the total system which is singularly important. Individual components need not have optimum design or performance on an individual basis because the validity is the end result of integrated performance. Between individual components a typical system will experience functional relationships which may either stimulate or hinder combined performance. These relationships are called "trade-offs" and systems technology provides a method for developing positive trade-off values. Finally, the major contribution of systems technology is the explicit result that components linked together so as to aggregate positive trade-offs will, as a total process, produce a greater end result than the sum of the individual parts.

Naturally, systems technology is not the exclusive domain of physical distribution. In fact little of a technique development nature has evolved from the phy-

sical distribution system analyst. However, the validity of the concept has been tested in a variety of applications including the space program a series of electronic applications and even heating and air conditioning applications. Once again, the important new horizon is that management can exploit another "here today" technology.

The Notion of Total Cost

A third area of substantial potential is the recent development of managerial accounting techniques for costing interrelated business functions. Most firms confront a serious problem in translating traditional methods of accounting into meaningful functional cost models. The entire notion of accounting is centered around the grouping of so called natural accounts along lines of organizational structures and primarily for the purposes of profit measurement, budgeting, and tax reporting. The problem is that the business activities of physical distribution cover a wide range of responsibilities normally administered by a variety of different managers within a single enterprise. While these managers attempt to do the best job possible, they may often work in direct conflict to the total system although it would appear they are performing well when viewed on an individual basis. This is a disadvantage to the total enterprise.

The paradox is that each manager can be expected to strive to perform as well as possible but spend as little as possible in the performance of his delegated responsibilities and the net result will very possibly be a higher than necessary total enterprise expenditure. From the corporate vantage point it makes little or no difference how much is spent on any single activity—for example, warehousing, transportation, or inventory—as long as the total cost of combined performance is at the practical minimum for the desired level of output in terms of customer service.

The notion of total cost is once again not limited to physical distribution. However, some noteworthy applications leading to dramatic total cost reductions have been reported in the physical distribution field. The problem in total cost analysis is to develop a viewpoint based upon managerial accounting that transcends traditional cost and accounting barriers. The concept of total cost has been proven viable and renders one more significant area of "here today" technology which can be used.

The Physical Distribution Concept

The combination of developments outlined above—computer maturity, systems technology, and total cost analysis—provides substantial reasons why management can expect to do a far better job in physical distribution during the years ahead. At a corporate level, physical distribution management is defined as that responsibility to design and administer corporate systems to control the flow of raw materials and finished

inventories. This systems concept is differentiated from the traditional orientation of performing the many integral physical distribution activities on a diffused or segregated basis.

The primary objective is to develop an improved physical distribution system capable of better than past performance. All firms have a physical distribution system of sorts. The immediate task is to strive for improvement. The *notion of optimum* system design and performance can be left for classroom contemplation. The professional manager's job and goal is to make things operate a little better each year than they operated last year.

Firms that have moved toward more integrated physical distribution systems have experienced noteworthy results. Systems technology offers a framework for evaluating improved systems. Total cost provides a new perspective for measurement. The computer offers a device to implement and control systems improvements and to evaluate integrated cost expenditures.

The primary task is to take a realistic position concerning desired standards of customer service. Such service must be viewed in terms of inventory availability at point of purchase and the capability to replenish inventory stocks of customers or sales outlets on a rapid and consistent basis. The attributes of high availability, rapid replenishment and consistent delivery cycles all have related costs.

The managerial task in physical distribution is to select a level of performance and then make the "on paper" objectives come true in practice. This requires the allocation of inventory within an integrated network of facility locations, transportation capability, and communication linkage. The primal task is to discover and implement the system configuration that will meet the objectives at lowest total cost. In many cases such systems will require substantial modifications of existing facilities and organization. The breakthrough opportunity may well be one quite alien to current methods of doing business.

The Question of Improved Business-Government Procurement Relations

The prospects for significant improvement in commercial progress in physical distribution during the immediate future are bright indeed. This unfolding change in general commercial modus operandi raises several interesting problems and opportunities for improved government-business procurement relations. A few more noteworthy aspects are discussed in the following paragraphs.

A Review of Standard Bidding Procedures

As firms that supply government move toward more integrated physical distribution systems, the traditional concept of purchasing at the lowest bid should be the subject of careful review. Logic would dictate that specifications for procurement must transcend the

physiocratic bias noted earlier. A given item can no longer be properly viewed in terms of pure item specifications. Purchase of such items f.o.b. plant with subsequent movement at Section 22 rates and service levels may negate, at the penalty of incurring greater real total costs of procurement, the integrated service capabilities with respect to time and place delivery normally offered by the vendor.

Just as the physical distribution system of government suppliers will increasingly be designed to provide a specified service at a total cost expenditure, government procurement systems will face a requirement to differentiate among bids on total value received. Such value is only significant with respect to getting the desired product where it is needed, when it is needed and in the correct assortment and quantity needed.

The argument simply stated is that total cost is a two-way street. The real purchase value received must be evaluated in terms of cost and time required to move the item to the point of government need. For example, assume a need exists on the west coast for a specific item manufactured on the east coast. The item could be purchased f.o.b. plant and subsequently be moved within the government logistic system to the point of need on the west coast. A logical alternative is to purchase the required quantity of the item on a delivered basis in which case the shipment might well be made from the vendor's west coast distribution point. The government can be expected to pay more on a delivered basis but might well receive greater value for the dollars spent. In short, benefits of total cost savings may well be realized.

From a public policy viewpoint, consider three reasonable results of purchasing on a delivered basis rather than the traditional lowest cost bid. First, there is no reason for the government to duplicate a distribution service currently offered by the vendor nor is such activity in the public interest. Second, government risk can be reduced by using the vendor's distribution system as a positive trade-off in terms of shorter supply lines. And, third, the vendor is not placed in the position of drained-off volume at the plant level. If such volume is allowed to move in the normal physical distribution process the per unit total cost delivered to each market can benefit from aggregated volume and resultant economy of scale.

As commercial firms develop more effective and efficient distribution systems the government procurement activity may well find far greater value by paying a little bit more for the right to receive not only form value but also time and place value.

The Question of Who Should Do What To Realize Logistical Flexibility

Similar to the value received argument above, however, somewhat broader with respect to facility requirements, is the question of who does what and who

should do what in typical business-government relations. The standard practice over the years has been for various government agencies to engage in physical distribution system operations (normally called logistics).

From the viewpoint of utilization of scarce resources (tax dollars) this procedure appears to have contributed to interfaces which could become serious from a performance viewpoint in times of extended emergency or high priority demands (Vietnam). Under normal conditions the governmental logistical effort is naturally directed toward achieving the lowest cost procurement possible. In other words, purchase as cheap as possible, move as cheap as possible and warehouse as cheap as possible. The fact that this lowest cost system does not have to meet the benchmark of a minimum level of return-on-investment on either inventory or facilities tends to place emphasis on lowest cost paid for required services rather than time or consistency of service. While a case could be made that such a form of performance measurement is, in fact, a near perfect violation of total cost analysis noted earlier, such is far beyond the intent of this article. Suffice to offer the premise that current budget restrictions have resulted in a priority on individual lowest cost expenditure for each required activity given normal demands.

The critical problem appears to be one of inflexibility when confronted with a high priority mission. In the short run a high priority mission is satisfied by the deployment of specialized capability held in a high state of readiness and supported by a stockpile of immediate resources. However, over a period of time, if the priority mission prevails, a natural deterioration in logistical capability sets in. The back up system, geared to lowest out-of-pocket expenditure and situated with facilities to handle such lowest cost movement, cannot easily adapt to a rapid switch of emphasis to high priority demands. Thus, the inflexible structure adapts to the mission in the only way possible—more inventory and fixed facility investment. This is the way to win the game because these two methods of adapting do not substantially alter the total unit cost of procurement. They do, however, increase the total cost of the government doing business.

Three brief outcomes might be considered as by-products to the above case. First, for a period of time the priority mission may be placed in jeopardy while the low priority system scrambles to adjust. It seems inevitable that this inflexibility will lead to overall expansion of specialized or reserve capability held in a state of readiness to prevent logistical dissidence in times of future national emergency. Second, during periods of high priority demand we can expect to experience disproportionate total expenses as the low priority system struggles to adapt. For example, critical parts will continue to move in larger quantities, in slow speed ground transport and through a fixed se-

quence of material centers in domestic pipelines only to be expedited by air in international pipelines. Finally, with the cutback of high priority demands, we can expect, based upon past experience, to be over committed and in a surplus situation. This is due to the length and expanded breadth of supply lines and an overfacility situation resulting from expansion of the precludes low priority network capacity.

While the above case may at best represent a partial description of reality, assume it is generally correct for purposes of contemplating some alternatives now available as a result of more exacting commercial physical distribution input to the government procurement system.

As a general case, the procurement problem can be stated as one of developing the lowest total cost replenishment system for use in times of normal mission while building in flexibility for rapid adjustment given a high priority requirement. Under the premise that commercial firms are, in fact, making rapid advances in the development of integrated physical distribution systems, a revamped government logistics operation should make full use of this available capacity. The vital linkage between business and government might well rest in the computer and high speed data transmission.

Utilizing existing computer capacity available in government in-house operations, the basic procurement system to support any given logistical mission or missions could be described in a simulation model. The primary advantage of system simulation is that total cost measurements can be implemented on an experimental basis without costly alteration of existing physical facilities. From such simulation at least two immediate results can be expected.

First, the minimum arrangement of fixed government facilities necessary to support low priority missions can be identified in terms of total cost justification. Such a logistical network would take into consideration the integration of existing commercial physical distribution systems which supply material on a regular basis. The simulation would be expected to fully utilize commercial resources in terms of inventory, warehouses, and transport while supplementing with government operated or contracted facilities at critical points in order to develop a logistical network. The role played by the Government in such a network would be similar to that of an information nerve center in air traffic control. The Government would operate the total information system by tracking and directing material movement in the computerized simulation of the logistical mission. Such an arrangement would offer greatest flexibility since the Government would be committed to an investment in computers and communication capacity and not the traditional concept of massive material centers.

Second, those components essential to the support of a high priority mission could be identified in terms of

a supplemental simulation model. For example, one input could consider required leadtimes to implement critical ordnance manufacturing. A second series of input could provide an updated inventory status of critical supplies normally held in commercial stockpiles. A third source of input could be a catalogue of alternative methods of utilizing manufacturing capabilities with required transition times. In short, the high priority simulation would maintain the necessary input data to formulate a logistical plan given the advent of high priority requirements.

Such a simulator would be capable of formulating a time sequence program predicated on the appraisal of the critical need. This plan would then detail the logistical commitment necessary at each performance level given the available catalog of critical inputs. The element of flexibility would be at a premium with alternative degrees of commitment being a function of national security. The critical factor of time is compacted and the degree of actual implementation would be calibrated to the probability of events rather than pure forecasts. Since mobilization has always been a problem, such simulations appear one available way to adjust to the rapid pace of events characteristic of the 20th-century world. From a planning viewpoint, it goes without saying that a wide variety of possible priority situations can be simulated prior to actual occurrence.

Conclusion

From a simple review of current events in commercial physical distribution, this brief article has transcended a wide range of what might appear as "blue sky" government-business orientations. However, a few basic thoughts serve as stimulants to this consideration of traditional methods of government procurement. First, the technology is "here today" and is limited only by the degree of imagination of responsible business executives and government officials. Second, the cost of procurement in the cold war phase of the thermonuclear weapon era prohibits very many mistakes. Third, the future seems full of uncertainty with one critical exception. The exception is that computers and data transmission have combined to create not only the "computer age" but perhaps a new concept which could be called the "temporal age." With the capability of compacting time in terms of all phases of information processing and transport capability the era of warehousing in anticipation of need may soon give way to rapid response massive total information systems. One of the most vulnerable traditional networks to this passing technology is government procurement. And, for the very same reasons it is vulnerable, procurement practice offers a perfect opportunity for significant improvement. Unlike the businessmen who strive to do a little bit better each year, the critical nature of government performance requires that a great deal be done better with each passing year. □

Productivity Improvements in Aircraft Rework Through—

DEFENSE INTEGRATED MANAGEMENT ENGINEERING SYSTEMS

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THE Naval Air Rework Facility at North Island has saved millions from "DIMES" in a relatively brief period. This has been accomplished through improvements in productivity.

Depot level rework of Navy and Marine aircraft, engines, and components is the primary function of the Naval Air Rework Facility. The facility is big business—employing 7,800 military and civilian personnel in over 100 different trades and occupations. The command occupies seven buildings and is spread over 298 acres of Naval Air Station, North Island, in San Diego. Machinery and equipment is valued in excess of \$73 million. The annual civilian payroll exceeded \$68 million during fiscal year 1968 and promises to be higher this year.

Effective production manpower management presented a challenge to the command because of the variable factors involved in its operations. Providing the level of fleet support which is the mission of the facility requires the attainment of firm schedules at minimal in-process times and at costs competitive with other Government agencies and with private industrial firms.

Productivity Problem

To the industrial engineer, effective production labor costs control requires the double-barrel approach of improved work methods and Engineered Performance Standards (EPS) at the operational or individual worker's level. The development and application costs of EPS were complicated by the highly variable nature of this work.

- First, the aircraft were not new; they were operational and were cycled through the rework facility at specified tour intervals.
- Second, the low production volume varied from two to 250 aircraft per year.



Assembly phase of the H-53 rework. This mammoth helicopter is one of four helicopter types overhauled at North Island. The components are overhauled there too.

- Third, the task per aircraft varied due to its operational service environment, the flight hours logged, the technical configuration, the mission modification requirements, and, in some instances, the deletion of portions of the task to gain minimal turn around time. (This task was identified as Progressive Aircraft Rework (PAR), Modification (MOD), or PAR/MOD combination.)
- Fourth, weapons components cycled from the fleet are also overhauled.
- Fifth, this rework command requires a wide variety of technical skills in its six production divisions, as shown on figure 2.
- Sixth, this command provides support and manufacturing services to squadrons deployed in the area.

Potential Predicted

Competent industrial engineering consultants predict a 20 to 35 percent productivity improvement through the effective application of adequately designed labor control systems based on engineered performance standards implementation. Preliminary analysis of the potential at this command by qualified Government and consulting representatives showed a similar expected potential.

These labor control systems are not predicated on a "speed up" process. Instead, they rely mainly on: improvements in the quality of services; management decisions related to production methods improvement that reduce the task; and improvements in the utilization of all available production resources (labor skills, production facilities, tools, and production materials). Realization of this potential may require several years.

Pre-DIMES Period

Prior to 1949, the use of time devices for measuring the employee's work movements was prohibited by law.* In 1949 this restriction was removed from appropriations. In the early 1950's the Naval industrial-type activities initiated a management improvement program that included implementation of the Performance Standards Program under the training and guidance of a private consulting firm.

In 1963, a top specialist from the Office of the Assistant Secretary of Defense (I. & L.) was assigned to provide technical guidance in the implementation of the Navy's Pilot Management Improvement Program (MIP) at two rework activities, Quonset Point and Alameda. Initial MIP emphasis was placed on the expansion of Engineered Performance Standards as begun under the Navy's Performance Standards Program. The Department of Defense designated this as the Defense Integrated Management Engineering Systems (DIMES) Program.

In October 1965, after 2 years of successful operation at the two "pilot" activities, the DIMES program implementation was initiated at this command.

DIMES at NARF

The prototype DIMES program required the maximum economic utilization of Engineered Performance Standards in performance evaluation, the development of improved methods, the utilization of labor-saving equipments, the application of EPS to production and manpower planning and to standard cost accounting, and required the reporting of resultant cost reductions.

*Motion and Time Study, B. W. Niebel, 3d Ed., p. 8, Library of Congress Catalogue Card No. 62-11279.

Naval Air Systems Command "DIMES" directives required a minimum of 60 percent EPS coverage by July 1968. To this command, this meant that 60 percent of all direct manhours expended on production operations susceptible to EPS were to be measured by the EPS techniques of time study and standard time data. Naval Air Systems Command directives also included the key statement:

"Benefits of High Quality—NAVAIR considers methods improvement a major benefit of high quality standards. Although methods improvements can be undertaken independently of time standards development, a significant contribution to the total benefits of methods improvement results from the investigation required to establish high quality standards through proper time and motion study and Elemental Standard Data (ESD) techniques. Adequate standards backup data are often fundamental to a convincing demonstration of the benefits of revised or new methods."

Navy directives also emphasized the use of Elemental Standard Data to obtain the specified EPS quality level at a minimal development cost. These also directed the use of the Office of the Civilian Manpower Management training agreement for DoD technicians, including the Army Management Engineering Training Agency (AMETA), and the maintenance of on-board instructor capability as certified by AMETA and the Methods-Time Measurement (MTM) Association. Or-

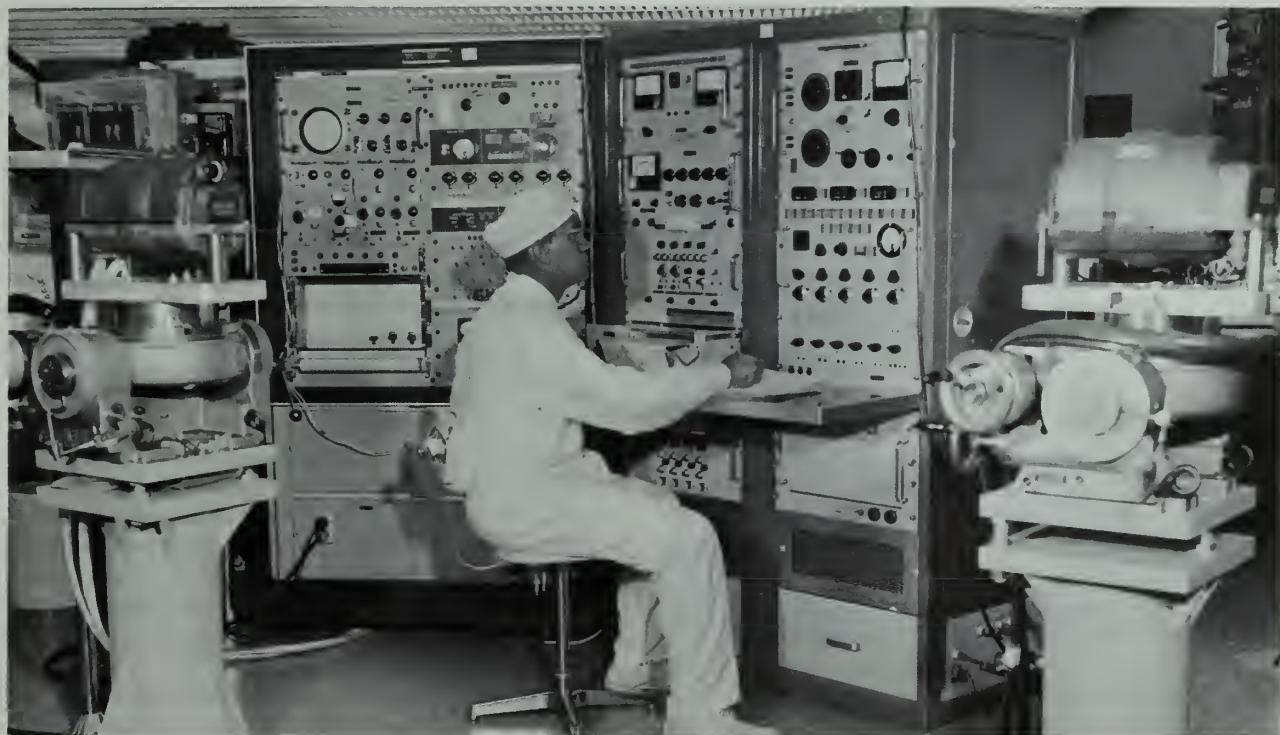
ganization, staffing procedures, quality specifications, goals, administration, feedback analysis, standards maintenance specifications, progress and most reduction reporting were specified by Naval Air System Command Headquarters directives. Their thoroughness has been a major contribution to the success of the DIMES implementation at this command.

Standard Data System Advantages

The application of predetermined time data systems to *jobbing work* has been considered by many industrial engineers to be too costly for the benefits obtained. The space is too limited here to discuss this subject in adequate detail. However, the reader has only to refer to the statistics of probability as applied to the variation in time-studied elemental time values to recognize that the cost of an adequate number of cycles (or product operations) by the time-study technique becomes extremely high.

Elemental Standard Data (ESD) Systems, on the other hand, represent a high initial cost which may be distributed over many product/operation time standards. The cost advantage of ESD over time study was recognized by Naval Air System Command management at the outset and directives were written accordingly. Experience confirmed the economical advantages of ESD in the development and application of EPS to the weapons rework operations performed at

Small corner of the Superclean Instrument Overhaul Facility at NARF. Operator is testing a guidance system which has been reworked.





Final cleaning of a bearing is handled in the filtered solvent spray booth of the Ultra-clean Bearing Processing Shop at NARF.

this command, an approach compatible with the EPS quality level specifications.

The NAVAIR Dimes program is a major participant in the DoD standard data repository program. The NAVAIREWORKFAC/ALAMEDA command acts as the repository and ESD training organization for the seven Naval Industrial Rework Facilities in the continental United States. They, in turn, represent NAVAIR in the DoD Standard Data Repository System for collecting maintaining, storing, and retrieving standard time data to be used by DoD components for achieving Dimes program goals and objectives. This command provided input standard time data to the repository, making it available to all Government agencies.

A recent survey at this command of ESD development and application shows that over 85 percent of the EPS hours applied to production operations were developed by the ESD technique. The cost of developing EPS hours by the ESD technique has been considerably less than that required for the time-study technique to maintain the same EPS quality level.

The usual added advantages of standard data include a lower standards maintenance cost for production task changes, the elimination of pace rating, consistency in time value, and the capability of developing EPS prior to the start of new work in the shop. The last is a substantial aid to the various production planning functions within the command.

A major cost advantage of ESD has been experienced in the aircraft disassembly and assembly divisions where elemental standard data time values for one model aircraft may be used for a distinctly different

model aircraft. This includes the tubing, electrical, structural, and other mechanical removals and reinstal-lations that have similar unit time values. The time-study technique would duplicate such development costs.

The ESD time standards were applied and adequate feedback data analyzed to assure their accuracy. Once this had been accomplished, the question of time standard validity became one of discussing the work method used by the shop as compared with the work method on the ESD backup sheet. Resolution is quick, accurate, and constructive in human relations value.

A recent experience with the exchange of over 10,000 standard hours of elemental standard data for a specific aircraft model with a sister rework activity showed that about 80 percent of the standards could be used "as-is" by that activity without change. The balance needed revision or replacement due to operating procedures peculiar to the second activity. The developmental cost savings of standard data interchange become realistic from this example. In addition, standard data for this same aircraft model was furnished an Air Force depot for similar use. The substantial benefits of the Dimes DoD repository should be obvious.

Team Effort

Probably no single factor contributed more to the productivity improvements through EPS application than the outstanding teamwork of all members of this command. This extended from the commanding officer to the journeyman at his bench and his line supervisor. Over 4,000 direct civilian personnel worked on production rework operations. Many are retired Navy and military personnel with strong technical backgrounds. The ready response of the production team to Pacific Fleet Air needs has been outstanding, breaking all previous production records.

The upper two management levels of this command are military, and the third and successive levels are civilian personnel. Reassignments of upper management members to other Naval commands has not interrupted the long-range plans for continued and effective Dimes implementation over the past 4 years. To the contrary, upper management members have directed the Dimes program with a vitality and understanding comparable with progressive managements found in well-managed private industrial firms.

The "key" management man in the success of the Dimes program has been the shop foreman, the line supervisor in the shop. The EPS analysts worked closely with him on methods improvements, incorporating them in the standard work method procedure. Management philosophy holds that methods improvement is every employee's business, and not limited to the old-fashioned "expert."

EPS provides the vital element of backup data not available from estimated, historical, or statistical stand-

ards techniques. The analyst has been trained to maintain an "open-book" approach with the foreman and his assigned journeyman. Any questions as to the economical method or the value of the standard are resolved factually and quickly by referring to this backup data.

A major factor in the effective implementation of DIMES was the people-to-people communications philosophy of the commanding officer. As noted earlier, the command has six production divisions, each managed by a separate superintendent. The commanding officer presided at daily standup staff meeting in these divisions, one division each day in succession for the entire fiscal year. This resulted in each division having one meeting a week, or 45 a year. The staff was composed of the division superintendent, all department heads (third level management), and the military management.

Major production problems were aired at the meetings, assignments made, and immediate action responsibility assumed by the concerned department heads. Items not resolved by the next meeting were then reviewed. People-to-people communications were highly effective, replacing hours or days delay experienced in written communications. The service department's supervisory personnel provided improved support to the production supervisor, and both worked in closer cooperation to resolve problems before they reached the next staff meeting.

Labor utilization procedures and systems provided a sound basis for management decisions. The production reporting system known as the Mechanized Production Control (MPC) system is highly automated, facilitating higher quality feedback reports for management's use. Source Data Automation (SDA) transactors in the shop are cabled directly to compilers at the data processing location.

The production worker, supervisor, production controlman, standards analyst, and operations analyst have individual identity cards. These inserted in the transactor with the job card provided flexible, accurate, and fast processing of production information. SDA transactors eliminated the need for manual reporting at the shop level and the costs of keypunching. They provided a higher quality of production and time data and reduced the reporting response time. Complete automation of time and production reporting has been the goal. Management decisions have been improved by the availability of these higher quality feedback information systems.

In summary, methods improvement and the effective support of the production operations by the service functions have been vitally important to the attainment of the higher production performance levels. Engineered Performance Standards implementation contributed to methods improvement and provided an impartial "yardstick" for production performance measurement. The automated source data reporting and

higher quality feedback information systems improved decisions at all levels.

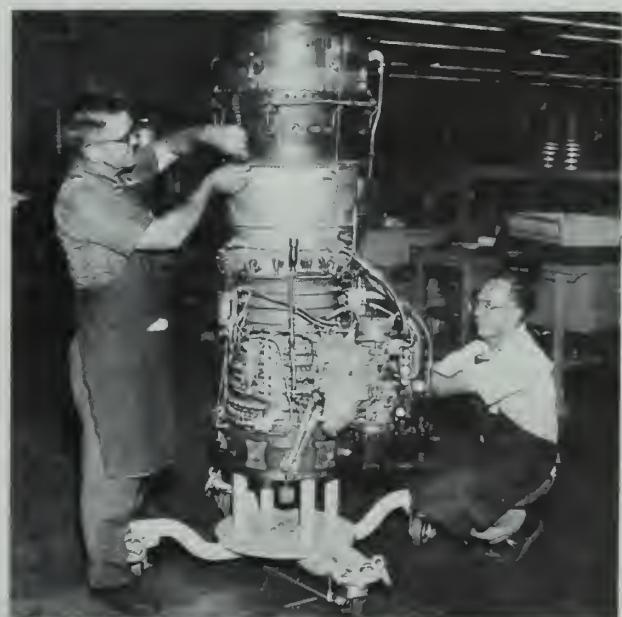
The people-to-people communications philosophy of management developed an informed team that responded to the needs of other team members. The "key" man in production performance improvement was the shop foreman. The foreman and workers under their supervision broke all past production records.

Cost Reduction Record Measured

The cost reduction record for the command over the last 2 fiscal years is shown below, with a division noted between and the amount attributable to the Dimes/EPS effort.

	Total	DIMES/EPS
Fiscal year 1967.....	\$17,875,000	\$14,111,000
Fiscal year 1968.....	35,400,000	25,021,000

Since the reader's organization may be a different size, the percent of productivity improvement on Dimes/EPS measured operations may be more meaningful. This was 22.5 percent in fiscal year 1967 and 25.8 percent in fiscal year 1968. Fiscal year productivity improvement compares the current year's performance level on EPS with the previous fiscal year's performance on lower quality standards for the same task. Although the fiscal year 1968 productivity improvement was somewhat higher, it did not account for the substantial difference in cost reduction amounts validated.



Final Assembly of T-64 engine by S. H. McMicken and W. J. Barbosa. The Naval Air Rework Facility also overhauls T-58, J-57 and J-79 engines.



North Island from 11,000 feet. The structures of the Naval Air Rework Facility are located in the lower right hand corner of the island.

dated. This was due to an increase in the average EPS coverage of 22 percent in fiscal year 1967 versus 53 percent in fiscal year 1968. At the close of fiscal year 1968, EPS coverage was 68 percent of all direct man-hours worked.

Results and Recognition

The command's cost reduction experience supports the 20 to 30 percent productivity improvement potential possible through the effective installation of Engineered Performance Standards and the implementation of related Dimes manpower management systems. This confirmed the expected goals of both the Navy and DoD. While the 25 percent productivity improvement level was realized in fiscal year 1968, current fiscal year 1969 indicators point to a higher productivity attainment potential.

Considerable management systems design work remains in the production scheduling and workloading areas to more economically align product input task requirements with projected production capability levels. Advanced management information systems programs now under development promise much in the resources planning areas of facilities, equipment, space, materiel, and manpower utilization improvement.

The cost reduction objectives of Dimes have proven to be compatible with the command's primary mission of supporting the Pacific Fleet. Productivity improvement has resulted in improved Pacific Fleet Air support at a lower unit output cost. While labor costs were 20 percent less on the average product, per component or per aircraft, the in-process times (product in shop and not available to the fleet) have been substantially reduced. The improvement in productivity has enabled the command to assume additional production pro-

grams while remaining at the same resources capability levels of manpower and facilities.

Productivity improvement suggests a concentrated analysis of the production operations. However, the experience of the command indicates that coincident improvements in the art of managing are mandatory for effective support of the production worker. Dimes provided the leadership and program structure for expanding Engineered Performance Standards as a "springboard" for further improving manpower management systems. "Dimes" to millions in productivity improvements has become a reality at this command.

On October 8, 1968, in the Pentagon, President Johnson presented the Cost Reduction and Management Improvement Program Certificate of Merit to Capt. William H. Shockley, Commanding Officer of the Naval Air Rework Facility. The citation reads:

"While meeting tight schedules for overhauling first-line aircraft for use in Southeast Asia, this organization—under the vigorous leadership of its Commanding Officer, Capt. William H. Shockley—innovated sufficient management improvement actions in fiscal year 1968 to reduce its operating costs 8.6 percent that year and 13.0 percent in the period fiscal year 1969 through fiscal year 1970. These management improvements—accomplished by highly motivated personnel throughout the organization and assisted by a well-organized program to cross-feed ideas—saved the Department of the Navy \$8,500,000 in fiscal year 1968 and will save an additional \$26,900,000 in the period fiscal year 1969 through fiscal year 1970."

This cost-reduction recognition is attributable in large measure to the effectiveness of the Dimes program. □

The Elimination Approach*

WHEN THE first privileged outsiders were given a glimpse of Procter & Gamble's Elimination Approach, their reports seemed too extravagant to be true. But what P. & G. now confirms is even more astonishing: In 1967, for example, in the manufacturing area, plant management people produced an average of more than \$20,000 per man, in new savings! They did it in an average of 5 percent of each man's time! They did it without releasing a single person! And they expect—and can show why—that the savings produced per man in future years will be many times greater!

To find out how they do it, *Modern Materials Handling* talked with Arthur Spinanger, associate director of P. & G.'s Industrial Engineering Division. On the following pages, the Elimination Approach is spelled out: three steps—that anyone can take—to a profit potential that, literally, has no limit.

STEP 1: Select the cost for questioning

It is important at the outset to recognize that there is a basic difference between the Elimination Approach and conventional methods improvement. The goal itself is different. Where the usual methods improvement aims at *cost reduction*—finding the better way—the Elimination Approach strives to *eliminate the cost completely*, and the operation, too, if it can get the same—or better—results.

Accordingly, P. & G. applies this technique first to those operations where there are large concentrations of cost, no matter how well-run these operations might be and regardless of whether they represent a good return on investment or not.

In other words, it is the amount of money involved in the operation that attracts the attention of P. & G.'s Elimination Approach teams, not necessarily a high cost per unit.

This is based upon P. & G.'s belief that perfection is no barrier to change. It is no coincidence that the overall company program, in which the Elimination Approach is a prime tool, is called the Methods Change Program.

Thus P. & G. can point to a great many perfectly satisfactory operations which were deliberately changed—with important savings—because their budgets showed the presence of large sums of money involved. This was the case in their much-discussed change over from wooden pallets to paper pallets and then to palletless clamp handling for case goods in their warehouses.

There was no question but that the wooden pallets were doing an excellent job. To *improve* the operation would have been very difficult. However, the tens of thousands of wooden pallets, costing \$3 to \$5 were a large cost.

Applying the Elimination Approach, they went to development of the push-pull attachment and used paper-sheet pallets. At a later time, they saw the scores of thousands of paper pallets—even at 50 cents each—as a large cost. So they developed the clamp truck which uses no pallets of any kind. This gave them an annual savings of more than \$500,000, in the total program.

Thus the first step in the Elimination Approach is the relatively simple one of selecting the cost target, with the emphasis laid on the largest amounts of money.

Some teams have a planned program in which they go through their entire areas of responsibility, questioning one operation or material after another in a cease-

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less check for large-cost items, in addition to those easily spotted in the budgets. In some cases, the day-to-day events lead them to new targets.

In one example, it became necessary to do some repair work on the roofs over some outdoor tanks. This led them to question the need for roofs anyway. They found that the materials' process had been changed and the former need to protect the materials against the weather no longer existed. Instead of repairing the roofs, they eliminated them.

All this should not be interpreted as saying that P. & G. ignores those operations that are not running well or suffer from high unit costs. The Elimination Approach can be used to attack any cost, and is. But the first point of attack is the size of the money involvement.

One technique used in the program, especially in the Industrial Engineering Division, is what P. & G. calls an "Elimination Dependency Chart." This chart helps in two ways: (1) it shows what supporting and related elements in an operation will be eliminated if the key element is taken out, and (2) it helps to show what the total money involvement in an operation is, beyond the key element's immediate and obvious cost in the budget.

In the sample dependency chart shown here, a proposed change from a labeled can to a lithographed can would suggest, obviously, that you could now eliminate the labels, the label machine, and the glue. But when you chart the operations in the form of a dependency "tree," in terms of operations, ingredients, equipment and supply, the full cost picture comes out clearly. It can be of special value to nontechnical people.

Further, the dependency tree can be used to suggest alternate changes, if the situation changes in the future. Assuming that investigation showed that lithography was not the answer, another look at the dependency tree might suggest that if the cost of pressure-sensitive labels had become low enough, you might at least eliminate that branch of the tree that deals with the glue.

Even if it does nothing else, the Elimination Dependency "tree" can provide a powerful mental reminder of the concepts of the Elimination Approach.

P. & G.'s approach to selecting costs for elimination casts a new perspective on some principles that other companies have expressed before, but only as abstract guidelines. When P. & G. says, "Never consider any item of cost necessary" they mean it literally. It is not an abstraction. And when they say, "The savings potential is the full existing cost" they mean that too.

So P. & G. says to its people, "Within the scope of your own responsibility, every operation or material, no matter how important or well established, should be open to question." This is one key to their success.

STEP 2: Identify the basic cause

The second step of the Elimination Approach is the

most important of all. It is the step that utilizes a unique key—to ask a single question, phrased with an unusual emphasis:

"If it were not for what basic cause, this cost could be eliminated?"

In the conventional methods improvement approach, you might ask, instead: "Why is this operation *necessary*?" or "What controls the *existence* of the operation?" But these questions will get the wrong answers. They force you to deal, one by one, with *obstacles* to change. The Elimination Approach is not concerned with explaining why an operation is there; its concern is to expose the opposite—the factor that controls the *elimination* of that operation.

This flip-flop in thinking is essential. The conventional questions tends to cause people to defend and justify the existence of the cost. The Elimination Approach question does not prompt defensive reactions as it identifies the basis of the decision originally establishing the operation and its subsequent cost. Often the cost elimination results simply when it is found that the basic cause is obsolete, a duplication, habit, custom, or tradition.

For example, in a story from France, a sentry was posted for 120 years over a park bench. If you had asked the current sentry why he was there, his reply would be that his sergeant posted him there. His sergeant could only tell you that they had always posted a sentry there. Neither explanation tells why the sentry could be removed.

But someone went back into the records, found that the basic cause was that 120 years ago the bench had been painted and a sentry temporarily posted to keep people off until the paint had dried. They forgot to make the second half of the order clear.

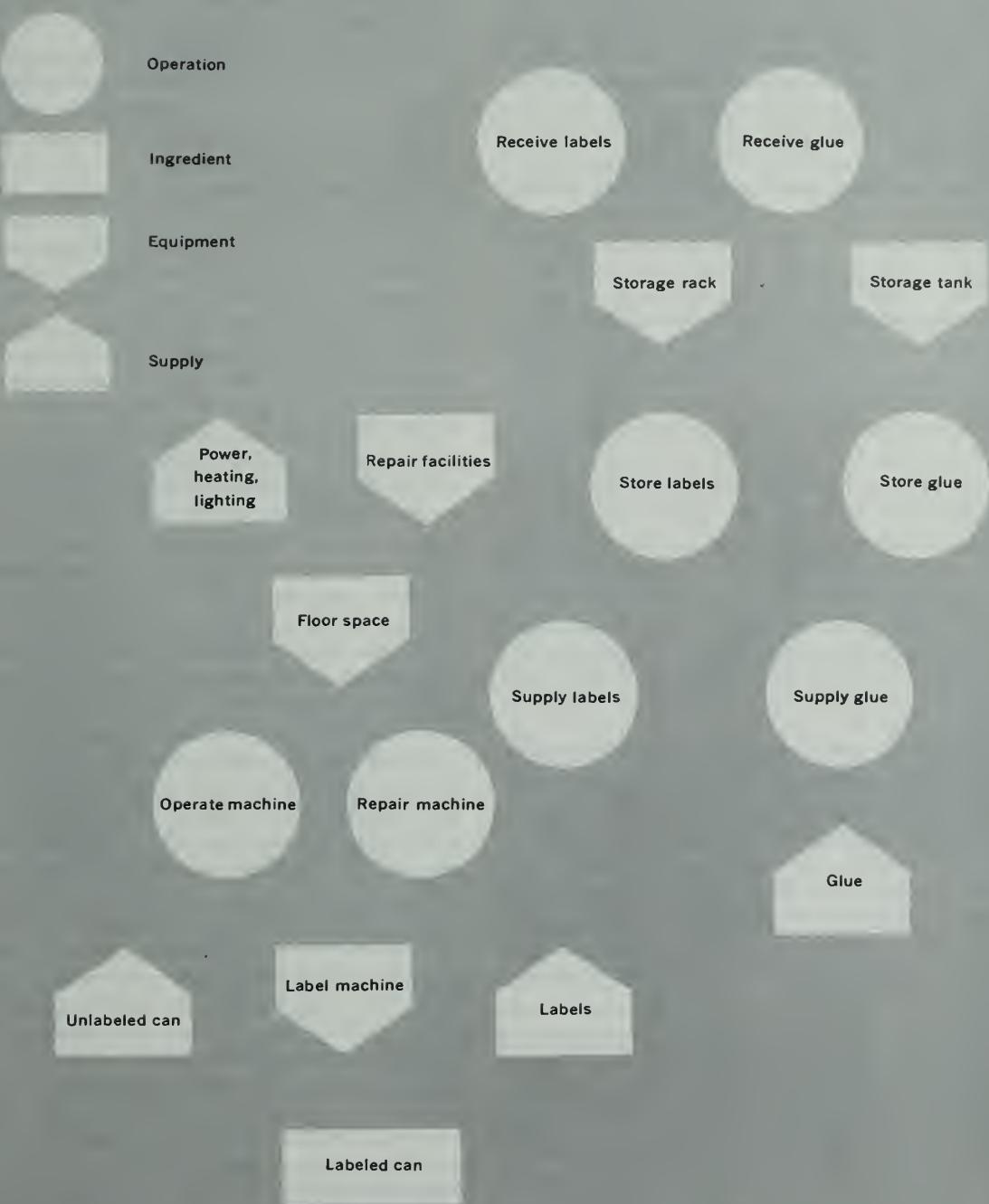
Once this basic cause was established, it became obvious that this cost could be eliminated.

This is the purpose of the unusually phrased question, to lead you to the factor that controls the *elimination* of the cost, not the opposite.

The use of the "If it were not for what basic cause . . ." question in the case of their warehouse pallet program led P. & G. to the conclusion that if it were not for the need for support for the case product unit load during transit and subsequent storage in the warehouse, they could eliminate the pallet. This led to the decision that if they could transfer the load support *once* to the lift truck—which was essential in transit—they could eliminate the support provided by *each* pallet. So they devised a way to duplicate the load-bearing aspect with, first, the push-pull attachment and later with the clamp truck.

While the elimination technique appears to be aimed at overcoming built-in obsolescence, it can also be used as a planning tool for new installations, with great success. The reason, of course, is that obsolete ideas can get into the new installations, too.

**THE ELIMINATION DEPENDENCY CHART—
A NEW TOOL FOR PINPOINTING THE SAVINGS POTENTIAL**



SELECT MAJOR COSTS FIRST—To find such costs, some P&G teams use an Elimination Dependency Chart like this one which shows the total cost elements of labeling a can. If the label can be eliminated, by lithography, for example, all dependent costs go with it. On the other hand, if a change is made to a pre-glued label, this would at least eliminate the operation, equipment and supply costs of the glue branch of the dependency "tree."

For example, in planning a new warehouse, P. & G. routinely applies the key question to cost elements. In one case, they asked, "If it were not for what basic cause, light switches in the warehouse could be eliminated?"

The line of questioning established the fact that the basic cause for light switches was to turn the lights on, to see, or *off* in certain areas, when not in use, to save power. But things have changed. Keeping lights burning all the time would cost \$300 a year in that warehouse. Providing switches to turn them off might make it possible to save \$150. But the switches would have cost \$7,200. It would have taken 48 years to pay for the switches. Once power was costly and switches cheap. But not any more. So they eliminated the switches.

The Need for Teams

It is during the questioning aspect of the Elimination Approach that another aspect of the P. & G. program shows its value: The use of teams. While a single person can do the whole job, it is more dependable and efficient to have more than one head at work during the search for the basic cause.

A great many of the basic causes are subtle, are forgotten, or may be technical. The greater the range of experience, the faster the true causes come to light. Too, there is a mental discipline in the odd phrasing of the key question. It is very easy to give the wrong answers—why the cost is necessary instead of what controls its elimination—when you are working alone. Several people, attacking the cause together, keep each other on the track.

In one case, the basic cause was found only by going outside the area of responsibility of the team. They were seeking the basic cause behind the use of multicolored and higher cost printing on their shipping cases.

A member of the team, knowing something about marketing, suggested that they ask the advertising department. These people explained that, in the past, the multicolored printing was used to enhance the containers appearance and thus the sales potential of the product.

But, they said, shipping cases no longer are used in this manner. With this knowledge, the team saw that all they needed on the case was enough information to tell what was inside. So the extra cost in multicolor printing was eliminated. This led to the decision that they could use colors, now, as codes to further help people identify contents. So each product's case is now printed in one color, essentially a separate color for each product.

Once the basic cause has been identified for a given cost element, it is frequently apparent at once whether or not the cost can be eliminated completely. When it can be done, an immediate 100 percent saving results.

But in many cases, the conclusion is not as simple as saying, "Okay, we won't put light switches in the new warehouse." This leads to the third step.

STEP 3: Question the basic cause

In the usual case, even though the basic cause of a cost element is identified, it may not be possible—immediately—to eliminate the cost.

Step three of the Elimination Approach is a method of determining: (1) If you can eliminate the cost completely, (2) if you can eliminate it partly, or (3) if you should seek an alternative and lower cost way to perform the same operation.

You start this process by considering what would happen if you *disregarded* the basic cause. P. & G. recommends two procedures: (1) Determine the area of influence of the basic cause, and (2) determine the associated price tag of the basic cause.

In determining these two factors, the dependency chart can be helpful, again. By charting the related equipment, operations, materials and supply and labeling each with its cost, it becomes possible to see the relationships of influence and cost clearly.

It is when you are considering what will happen if you disregard the basic cause that the need for technical advice and engineering skill is most likely to arise.

For example, the basic cause for having roofs over those outdoor storage tanks was that the product (lye in solution) might be diluted by rainwater. By themselves, the team could not say what would happen if they disregarded the basic cause and removed the roofs.

They asked their technical people. The answer was that any dilution from rainwater would be canceled out by normal evaporation. Elimination was safe.

It is also possible that removing the basic cause, and the cost element, from an operation might have related consequences, either cost increases elsewhere or opportunities created elsewhere. The examination of area of influence and associated price tag is aimed at catching these.

Frequently, one finds that the basic cause cannot be disregarded. For example, every shipping case of P. & G. products used to carry a code mark on four sides of the case. In questioning the need for this operation, it was found that the shipper and retailer needed the code information to know what was the freshest stock, an essential factor in proper stock rotation.

A part of the associated price tag of this basic cause was retail store satisfaction and sales. It was decided that a code was needed on the case. But the question was raised as to whether it had to be repeated on four sides of the case. The answer was no. The code now goes on one side, a partial elimination—saving thousands of dollars in operating costs.

This is a formal part of the procedure. Once it is found that a cost cannot be completely eliminated, P. & G. looks for a second opportunity. This is done

How the Elimination Approach Differs From Work Simplification

	Work simplification	Elimination approach
END RESULTS		
Operating costs.....	Reduced.....	Eliminated.
Installation costs.....	Usually some....	Usually none.
Administrative duties....	Still exist.....	Eliminated.
TECHNIQUE REQUIREMENTS		
Thorough knowledge of operation.	Usually needed.	Usually not needed.
Paperwork and calculations.	Needed.....	Do.
Engineering skills.....	Usually needed.	Do.

The KEY DIFFERENCE is that where work simplification and other types of methods improvement seek to upgrade what exists, the elimination approach seeks to eliminate what exists, as long as the same results can be obtained at zero cost. Because of this key difference, the Elimination Approach is used first, and work simplification is still applied to those operations which have not yet been eliminated.

through the application of the question "why" to all aspects of the basic cause.

They ask: "Why this person?" "Why this place?" "Why this time?", "Why this way" and so forth. They go back upstream from the operation and question the source. They question for alternate possibilities seeking the lowest cost alternative, preferably one with no cost at all. They question the operation for duplication. Other operations being done may, with little or no change, accomplish everything that is essential.

They question all the supporting factors of the cost element in question: Frequency, material, temperature, amount, pressure equipment and so forth.

Once the three steps of the Elimination Approach have been completed, the chances are good that a saving greater than those possible under any other approach will be made.

But a major advantage of this approach lies in its regular application to operations that do not appear at the time to offer possible savings because they work well.

In one case, a detergent case consisted of one layer of six cartons with a support sheet in the middle. There was no complaint with this container. It was working well.

But a packing department manager, acting on the principle that perfection is no barrier to change, suggested that another way of packing the container would be in two layers of three cartons each. The change was

tested on the product in question. It was found that the support sheet could be eliminated and less cardboard used in the case. The same principle was found to work for other brands and the change was made for an annual saving of over \$100,000.

This type of saving is improbable, or takes much longer to bring about, under normal methods improvement techniques, but is typical of what the Elimination Approach achieves in P. & G.'s deliberate and systematic Methods Change Program.

A savings potential without limit!

Procter & Gamble's experience has shown that the Elimination Approach can make every member of the management team a major cost cutter—a profit increaser—on a consistent basis. As said previously, they saved more than \$20,000 per team member last year, using only 5 percent of each man's time.

The systematic series of questions enable average people to perform like geniuses. And where even the genius depends on luck and intuition, this approach makes high performance a day-to-day achievement.

Good achievements have been made, and are still being made, by use of simplification and other methods improvement techniques. But there are some big advantages in the Elimination Approach: first, a person's usual questioning approach becomes far more direct, more penetrating, and more effective in wider areas and second, it aims at vastly greater savings.

Further, there is no limit to the amount of money that can be saved. P. & G.'s savings have been rising steadily through the years on a steep curve.

This increase, according to P. & G., will continue indefinitely. They say the curve need never flatten out. There will always be savings of large magnitudes to achieve through the operation of the program.

This sounds like a paradox. How can you keep on taking ever-increasing amounts of cost out of an operation without finally reaching a zero point?

The answer lies in two things: the nature of the savings and the relationship between operating costs and volume of business in a dynamic world.

Perhaps the best way to explain the nature of the savings, created by the Elimination Approach, is to compare them to the kind of savings achieved by methods improvement techniques.

The basic goal is different. Methods improvement seeks to find a better way to do the job. It works in terms of cost reduction. They have a saying at P. & G.: "If you look for a better way, an awful thing will happen...you'll find it."

This is a way of saying that changes may be minor, the savings limited, and you will still have the operation. A methods improvement program usually aims for a 20-percent saving. The compromise generally settled for is 11 to 15 percent.

P. & G. regards a 20-percent saving as almost a failure. Their goal is ". . . zero cost . . . to get the same or better results without spending any money." Their aim is at the top end of the spectrum. They strive to *eliminate* the cost completely—and the operation, too, if they can get the same result—and their compromise lies in backing down from 100 percent to, say, 89 percent. Their overall average savings run well above 20 percent.

The kind of expense item, at which the Elimination Approach is aimed, is also important. It is a kind of cost item that lies hidden in the best-run operations in the best-run companies.

In theory, every time a change takes place in a company operation, everything related to that change is evaluated and adjusted. In reality, this doesn't happen. Changes are subtle and often seem unconnected.

A simple example: When shipping case flaps were glued by a man with a brush, glue drips used to fall onto the product inside the case. To protect the product, P. & G. inserted a protective sheet of paper under the flaps. Then came automatic case sealers, which don't drip glue into the case. But no one thought to stop putting in the protective sheet until the Methods Change team, using the Elimination Approach, ques-

tioned its presence and saved thousands of dollars by eliminating it.

This is a typical Elimination Approach saving. Industry seethes with similar opportunities. The world is continuously changing. This is one reason why the P. & G. savings increase curve will not taper off.

The other reason is the relationship between operating costs and business volume. If P. & G. were to reduce their total operating cost for a product significantly, they could pass along the saving to the customer so that a cake of soap would sell for less than what competitors could sell it for. This would result in a much larger volume of sales. While the unit cost of the product might be lower or even remain the same in the face of rising external costs, the volume of money would be greatly increased with the new sales volume, giving a new and larger total cost to be attacked for further savings.

The success of the approach in the plants has led to a program to extend it throughout all aspects and levels of the company. This is now underway and it is the results of this type of thinking—along with other progressive actions—that have enabled Procter & Gamble to keep the prices of its products down—which is vital to their operation in some of the most highly competitive areas of the market place. □

UPLIFTING UNDERTAKING

Forklifts move mobile truck ramps from one dock location to another at Defense Depot Tracy, California. The forklift's blades sometimes slipped against bolt springs in the ramp's undercarriage and damaged these springs.

No more, though. Welder Theodore Clark (right) shows forklift operator Everette Dickens his safeguarding suggestion, to wit: weld two angle iron braces to the undercarriage of the ramp to keep the forklift's blades from contacting the bolt springs.





- "For Viet Nam Veterans, New Skills and Better Jobs," *Nation's Business*, October 1968, pp. 84-93.

Project Transition was created in 1967 to help ease the change from military to civilian life by providing servicemen with counseling, education, training, and placement for civilian jobs. It was particularly aimed at those Vietnam veterans whose inservice training would not lead directly to civilian employment. After initial success at five pilot bases, it was expanded in January 1968 to all major troop installations in the United States.

Counseling is vital to the Project; often a man will have no idea of what is involved in learning a skill or whether he has any aptitude for the field. Sometimes, after tests and counseling, a man will decide to reenlist and continue to use his military skill. The priority system gives preference for training to veterans disabled in combat, soldiers who had no civilian occupation and did not learn a marketable skill while in service, and those ineligible for reenlistment. In practice, almost anyone who wants to participate in the program is able to do so. Anyone who has not finished high school is urged to take a course which prepares him for the equivalency exam before attending classes in a particular civilian skill. Vacancies in classes offered by the Armed Forces may be filled by Transition participants preparing for civilian employment, despite the fact that they may not be eligible for this type of training in connection with their military careers. Participants can get on-the-job training through cooperation with local industry or through nationwide programs established by large corporations.

Project Transition relies on involving public-supported agencies and private industry, which Director Frank M. McKernan feels is essential to its success. The military offers industry a manpower pool that requires no recruiting because base Project offices administer tests and select only those applicants best qualified for the training industry offers. Many companies appreciate the mature attitudes and determination of men actively seeking to improve themselves. Humble Oil, for instance has graduated 400 men from its 12-week course and helped them find service stations to manage throughout

the country. General Motors locates dealers who will guarantee the trainee a job in the area in which he wants to live; he is then trained at GM facilities like the mechanics center in Fairfax, Va., and sent to his job. Local government agencies also have helped provide much of the training, personnel, and facilities for Transition. The Los Angeles Police Department designed a course offered on base by a local college from which graduates go on to join police departments throughout the country. In one program in St. Louis, Mo., men start with on-base instruction provided by Webster College and continue with after-discharge education on campus, graduating as teachers for the inner-city schools.

Despite a constant lack of funds that hampers recruitment of trained counselors and cancels needed programs, the Project has counseled 111,000 men and 15,000 have begun some sort of training; only 5 percent of those who begin training do not complete the course. Unfortunately, many 2-year draftees go straight from basic training to Vietnam, and returning with only 5 months left to serve, receive early discharges without ever coming into contact with the Project. For this reason, McKernan hopes to make Project Transition part of the recruitment program rather than the afterthought it now is. However, Project Transition has proved extremely popular with the men, and their enthusiasm is probably the best advertisement it has for reaching others in the services.

- Alexander, Tom, "Shipbuilding's Big List from Aerospace," *Fortune*, September 1, 1968, pp. 78-84 ff.

U.S. shipyards are beginning to abandon their ancient job-shop methods in favor of "systems" design and manufacturing procedures similar to those of the aerospace industry. New naval procurement policies and the entry of such technologically sophisticated companies as Litton, General Dynamics, and Lockheed into the shipbuilding industry are forcing this change.

During World War II, assembly-type production techniques were used to produce large quantities of like vessels. These production techniques fell into disuse after the war because orders for new ships were small due to the surplus capacity in military and commercial fleets. In more recent years, inefficiency resulted mainly

from the Navy's practice of dividing orders for similar ships among different shipyards and the anticompetitive effect of Government subsidies on commercial shipbuilding.

The new thinking in naval procurement, developed under McNamara, has already had a substantial impact on the industry. In 1965 the Navy started to revamp its procurement system by adopting such procedures as design competition and total-package procurement from the Air Force; and computerized design, systems analysis, and careful matching of in-house design to in-house production facilities from the aviation industry. Unlike the shipbuilders, the U.S. aircraft manufacturers had retained and improved upon the mass-production and management techniques developed during the war in order to meet the large demand for commercial airplanes and the need to reequip the military with jet aircraft and missiles. In addition, the Air Force had initiated the practice of contracting its R. & D. to the companies that manufactured the hardware. This resulted in a whole series of procurement innovations including "total package" procurement, under which the contractor not only designs and builds the equipment but is required to furnish firm guarantees of its operation and maintenance costs.

The first Navy project to incorporate the new procurement policies was the proposed Fast Development Logistics Ships (FDL). While the old-line shipbuilding industry faltered in the heat of the competition, three aerospace companies—Lockheed, Litton, and General Dynamics—became top contenders. All were interested in trying to transfuse airframe techniques into shipbuilding. In July 1967 the Navy gave Litton the contract to build the 30-ship FDL system. But maritime interests, which viewed the FDL as a threat to their defense role, rallied sufficient congressional support to get the program dumped. Nevertheless, Litton is in shipbuilding to stay. It has already captured the contract to build the huge new amphibious assault ships (LHA), and in the \$2 billion competition for a sophisticated super destroyer called DX, Litton is one of the three chief competitors, along with General Dynamics and Bath Iron Works.

The Navy's shift to a policy of big orders to one contractor seems permanent although some of the industry, with strong support from Congress, continues to resist change. Several industry participants foresee a shakeout period in which perhaps five or six major firms will emerge instead of the present 17. Meanwhile, the Navy's experience indicates that it is possible to design more efficient ships and build them at much less cost. If so, the \$3.7 billion industry may recapture its lost ability to compete with foreign yards.

- Art, Robert J., THE TFX DECISION: McNAMARA AND THE MILITARY, Boston: Little, Brown, 1968, \$5.95, 202 pages, summarized by Tacy Cook, SAFAAR.

The TFX, the first major development program initiated by Robert McNamara as Secretary of Defense, provides a good example of the methods he applied in making development decisions. McNamara's approach was marked by attempts to obtain realistic cost estimates, make decisions as rationally as possible, strengthen the power of high-ranking civilians, and demonstrate the validity of the civilians' institutional perspectives. Throughout the negotiations over design, source selection, and cost estimates, tensions were increased by the conflicting interests and goals of the military services, the aircraft industry, and the DoD.

The problems began in February 1961 when McNamara decided to develop three structurally identical planes in order to satisfy the tactical fighter needs of all the services. The Committee on Tactical Air, after studying the requirements of the services, concluded that a single plane could not meet all their demands. It recommended, therefore, two separate programs: One to develop an unsophisticated, inexpensive, close-support aircraft for the Army and the Marines; and a second to develop a complex, high-performance aircraft for the Navy and the Air Force. As a result, McNamara agreed in May 1961 to develop two aircraft, asserting that one plane could satisfy the requirements of the Navy and the Air Force. The Navy mission of fleet air defense and the Air Force mission of long-range interdiction both required an aircraft with air-to-air missiles, a high-performance radar system, and an all-weather capability. Both services objected to a joint program, viewing it as a further step toward blurring their distinctively different roles and missions. However, they presented their arguments in terms of technical feasibility rather than service autonomy. McNamara was not convinced. He thought they were using technological unknowns as an excuse for justifying years of outmoded tradition and he believed that the variable-sweep wing design could perform all the missions involved.

In September 1961, when it became apparent that the Navy and the Air Force were unable to agree on specifications, McNamara issued a memorandum stating the specifications for the aircraft industry with instructions to submit bids by December 1. The resultant competition among the participating aircraft industries was the longest ever experienced due to their unfamiliarity with the requirements of a joint development effort, the demand for tremendous technological advances, the need to make decisions with incomplete information, and the opposition of the services to a joint program.

The services unanimously recommended that the contract be given to Boeing rather than to the General Dynamics-Grumman team. The Boeing development offered technological features on which the Navy and the Air Force both agreed, such as thrust reversers, air scoop location, and the use of lightweight titanium. They felt that the consequent operational advantages

would outweigh any increase in costs; but McNamara decided otherwise. He had done his own cost analysis of the bids and decided that Boeing had bid unrealistically low in order to "buy into the program" and make up its developmental losses in the production phase. In his view, the higher General Dynamics-Grumman bid represented a more accurate assessment of the costs of both development and production and would in the long run, save the Government money. Moreover, the issue of commonality for which McNamara had fought since the beginning of the program also led him to favor the General Dynamics-Grumman designs. The dissimilarities of the Boeing versions, designed to fit the specific needs of each service, helped maintain some semblance of the autonomy which the Navy and Air Force considered so important. The more similar characteristics of the General Dynamics-Grumman versions still met the service requirements, with the added advantage that their greater number of interchangeable parts made them more economical to produce. On the basis of all three points—performance, cost, and commonality—McNamara considered the General Dynamics-Grumman proposal better. Therefore he overruled his military advisers and awarded the contract to General Dynamics-Grumman in November 1962.

Thus, McNamara asserted his independence of the bureaucracy: He refused to accept a recommendation sanctified by tradition as a decision. In reversing the unanimous recommendation of his military officers, McNamara laid himself open to the charge of ignoring the judgment of experts. He therefore altered the decisionmaking procedures in order to prevent the military from blocking the results he wanted. To strengthen his control, he made it the function of the military to advise on the selection of sources rather than to recommend a source, and asserted that his perspective as Secretary of Defense made his final judgments the most valid.

- Haugland, Vern, "The Air Force Is The Biggest User," *Armed Forces Journal*, September 1968, pp. 24-29.

Two-thirds of \$294.4 million allocated to Federal Contract Research Centers in 1968 went to the six Air Force-associated centers: Aerospace Corp., \$72.2 million; Massachusetts Institute of Technology Lincoln Laboratory, \$66 million; Mitre Corp., \$32.9 million; Rand Corp., \$20.5 million; Electromagnetic Compatibility Analysis Center, \$4.5 million; and Analytic Services, Inc., \$1.5 million.

When Rand was first established in 1946, it was part of the Douglas Aircraft Co. In 1948 the Air Force sponsored its present independent status. Since its inception, Rand has received some \$205.8 million in Air Force contracts. In its first major study in 1946, Rand forecast the space age, predicted that it would be possible to launch a satellite within 6 years, and foresaw the military potential of satellites in communications, mapping,

reconnaissance, and long-range missile development. As the result of another Rand study, the Air Force reduced its overseas installations and concentrated on developing underground missile sites in the United States, at an estimated saving of \$1 billion. Rand's research in unintentional radio signal interference with weapons performance led to the establishment of a separate research organization, the Electromagnetic Compatibility Analysis Center (ECAC), which Rand continues to assist.

The current president of Rand is a former Deputy Assistant Secretary of Defense for International Security Affairs, while the vice president for research and the vice president for programs were formerly affiliated with the Office of Director of Defense Research and Engineering. About half of Rand's 1,100 employees have degrees, of which 35 percent are Ph. D.'s.

MIT was asked to establish the Lincoln Laboratory in 1951 to design and develop air defense and communications systems. Most of its 1,738 personnel have degrees, including 27 percent Ph. D.'s. MIT also sponsored the establishment of Mitre in 1958, to conduct research and engineering studies of weapon systems. Its 2,000 employees include 900 scientists and engineers, and its president is a former Deputy Director of Defense Research and Engineering.

In 1958 the Air Force helped set up Analytic Services, Inc., to do "software" analyses of Air Force operations similar to those of Rand. Its payroll, including the services of 50 professionals, is \$1 million a year. The president is a former Deputy Chief Scientist of the Strategic Air Command.

Founded in 1960, Aerospace Corp. is the largest of the "nonprofit" organizations. Its physical plant alone cost over \$19 million. Like Mitre, it provides research and engineering support in planning and developing Air Force space and missile programs, working on such projects as the Manned Orbital Laboratory, the Titan III, and Advanced Ballistic Reentry Systems. The president of Aerospace, a former Assistant for Development at Air Force headquarters, receives the highest salary of all "nonprofit" corporation employees—\$90,000 per year. Aerospace employs 3,767 people, including 1,800 scientists and engineers of who 16 percent are Ph. D.s.

During 1968 a non-panel committee selected by the Air Force Systems Command conducted a 7-month study of Air Force needs and capabilities for systems support for the next 5 years. Although the report has not yet been made public, it contains information suggesting that the highly paid employees of some "non-profit" organizations have been used in work that could be done equally well and as objectively by private industry, which operates with more modestly paid personnel. One panel found that aerospace fees average \$46,000 per man-year and Mitre fees average \$39,000; but a Maryland-based "profit" firm has performed Navy contracts on the Poseidon and Polaris missile programs for \$22,400 per man-year. □



IMPROVEMENTS IN HANDLING BULK CEMENT

Cementing beachheads the old, hard and costly way, men of the U.S. Naval Mobile Construction Battalion Ten break up bags of cement as they prepare the way for placing of an air cargo facility at Marine Quang Tri Forward Combat Base. Over 300,000 bags of cement were used in improvements at the Quang Tri Base.

THE Naval Facilities Engineering Command has recently revised and improved its method of handling and distributing cement used for construction by the Seabees in Vietnam. The new system, which was initiated in November, is expected to save the Navy approximately \$10 million each year after the first year of implementation by reduction in shipping, handling and port costs and by a 40-percent quantity reduction in the amount of bulk cement procured.

In the course of providing construction in support of Marine Corps operations in Vietnam, the Seabees have had to build many of their facilities on the very fine beach sand found in most of the major combat bases. It was found that one of the best ways to stabilize this sand was through the use of a sand cement mixture. In this type of construction, the site is leveled and graded, and sacks of cement are spread on the surface to be stabilized. The sacks of cement are opened by hand and the cement mixed into the sand—usually at the rate of one sack to 1 square yard. Water is applied, and when this mixture hardens, it is suitable for use as a base for roads and airfields.

However, the system has drawbacks. From the quality control aspect, the amount of cement can only be roughly approximated. Also, the system requires individual handling of thousands of sacks of cement. Over 300,000 sacks were used on one airfield project. Further, there was loss experienced in the conventional method of shipment because of breakage of sacks. Warehousing was required to protect the cement from the high rain-

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CONTAINERS FOR CEMENT

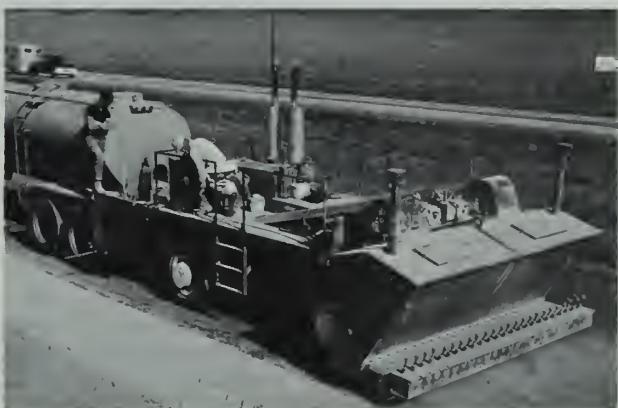
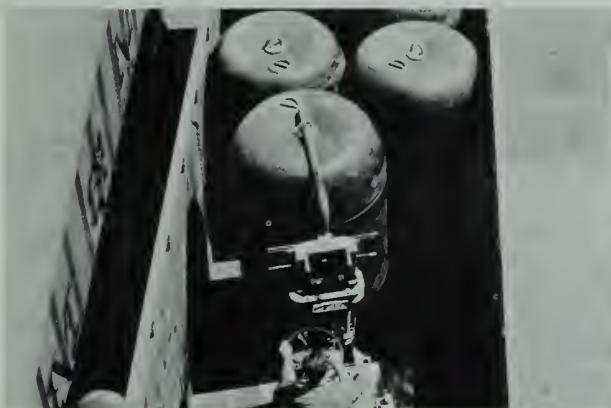
Empty



Filled



BARGED AND SPREAD



falls and humidity experienced in Vietnam.

Taking a close look at the situation, the Naval Facilities Engineering Command determined that (1) construction quality could be improved if the cement were distributed by a commercially available cement spreader and that (2) construction progress would be increased if the cement could be handled in bulk in containers which would protect it from the elements while in storage.

With this in mind, NAVFAC began investigating various bulk cement systems. Studies were conducted of several alternate bulk cement shipping methods, and it was found that some would require a higher capitalization cost and construction of cement silos and bagging plants in Vietnam; others lacked flexibility of being used in other theaters of operation; and still others did not satisfy the basic requirement of improving the construction operation.

After initial analysis of the method finally selected, the system was designed in detail. An impending substantial buy of cement created a time limitation which required that the system be operational as soon as possible. A further qualification required the system to be within the state-of-the-art and also within the production capabilities of the possible suppliers. The containers should be of a size that was manageable at both ends of the "pipeline," and elaborate handling and support facilities had to be avoided.

Balancing these constraints against the systems performance desired, NAVFAC selected a 66 cubic foot, rubber dry-product container, similar to that used for rubber fuel drums. This is the largest container which could practically be handled with existing equipment and which would be readily stowable on most ships.

The container is made of neoprene-coated dacron cord and vulcanized rubber reinforced internally with

steel cable. It is approximately 5 feet 5 inches high and has a 4-foot 8-inch diameter filled. It weighs 170 pounds empty. It is filled through the top, emptied through the bottom and handled by a forged lift-eye fitting on the top center. Filled bags may be stored in the open, without damage to the contents.

As a part of the contract package, the supplier was to provide facilities to transfer bulk cement from the cement producers equipment to the bags, and equipment to unload the bags at the receiving end.

From a systems approach, these containers have re-

lated benefits of reducing the warehousing required to protect conventionally packaged cement from the elements and of creating substantial savings in shipping and handling costs.

Once the system was designed in detail, a cost effectiveness analysis was conducted. This analysis considered purchase prices of cement, preparation costs for cement shipment, port handling costs, shipping costs—both to the objective area and retrograde shipping of empty containers. A brief summary is shown below:

	Present system	In millions	New system	In millions
Annual requirement.....	3.6 million sacks of cement.....		2.16 million sacks of cement.....	
Cement cost.....	3.6 M sacks at \$1.25.....	\$4.5	2.16 M sacks at \$1.10 bulk rate.....	\$2.38
Packaging cost.....	3.6 M sacks at \$0.44.....	1.58	.....	0
System cost.....	.....	.....	.....	4.
Port handling cost.....	279,000 M/T at \$10.50.....	2.93	96,524 M/T at \$10.50.....	1.013
Ocean freight.....	279,000 M/T at \$28.70.....	8.00	96,524 M/T at \$28.70.....	2.770
Retrograde.....	.....	.....	Return of empty bags.....	.415
Total cost.....	F.o.b. RVN harbor.....	\$17.01	F.o.b. RVN harbor plus retrograde cost....	\$10.578

Summary

First year (One-year amortization):

Before.....	\$17.01
After.....	10.58
Total.....	\$6.43

Following years (subsequent to amortization):

Before.....	\$17.01
After.....	6.58
Total.....	\$10.43

A quantity reduction factor of 40 percent was used in these studies due to the fact that, under the present conventional system, cement is often handled as much as 9 times prior to use, and high loss required over-purchase of cement. While the rehandling frequency will not be improved, the integrity of the container will be maintained, protecting the cement during storage and transshipment.

Based on the results of the cost effectiveness study, a meeting was held with representatives of the Naval Supply Systems Command, Naval Material Command, and the Chief of Naval Operations. As a result of these discussions, NAVFAC was authorized to initiate procurement. A competitive bid contract was prepared and issued by the Construction Battalion Center, Davisville,

R.I., and on 15 November 1968 a contract was awarded for 4,500 containers. Although this number of containers is not sufficient to meet the cement requirement, it initiates a phased test and implementation of the new system. Delivery of the containers to the Construction Battalion Center at Port Hueneme, Calif., began in January 1969.

While the bulk cement system procurement was underway, NAVFAC initiated procurement of three cement spreaders which will be capable of taking the bulk cement directly from the container and applying it in metered quantities to the sand, thus fulfilling the original intent of improving the Seabees construction capability. The spreaders arrived concurrently with the first shipments of cement. □

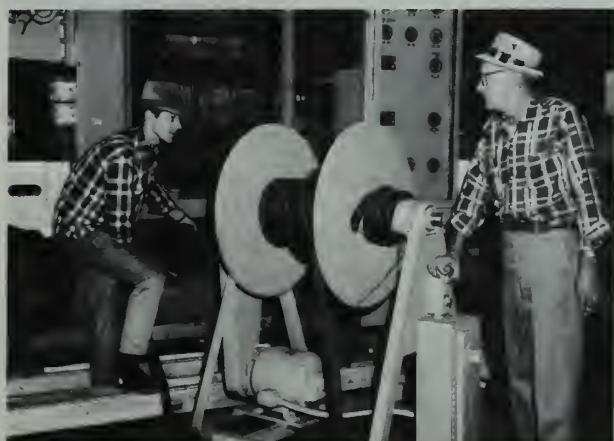
INCENTIVE AWARDS PROGRAM RESULTS FOR FISCAL YEAR 1968

SUMMARY OF GOVERNMENT-WIDE RESULTS

	F.Y. 1968	F.Y. 1967
EXTRA EMPLOYEE CONTRIBUTIONS		
Suggestions Adopted	145,623	141,535
Rate per 100 employees	5.3	5.3
Superior Achievements Recognized	97,390	88,424
Rate per 100 employees	3.5	3.3
MEASURABLE BENEFITS		
Adopted Suggestions	\$149,761,851	\$156,572,489
Superior Achievements	\$99,460,059	\$186,945,642
AWARDS TO EMPLOYEES		
Adopted Suggestions	\$4,799,686	\$4,392,715
Average Award	\$44	\$42
Superior Achievements	\$14,270,980	\$11,774,690
Average Award	\$159	\$151

TWO REEL IDEAS

Dave Winters (left) and Townsley Sullivan demonstrate the portable reel-rack used to move heavy test cables at Defense Depot Tracy's Directorate of Industrial Plant Equipment Operations (DIPEO) facility. The test cords, which weigh up to 500 pounds per 100 feet of cord, require the use of forklifts and additional personnel to move from one job location to another. Winters and Sullivan, working with another DIPEO employee, Clarence Reeves, Jr., came up with the idea of a mobile reel-rack. The suggestion, which earned the men \$15 each, is expected to result in savings of \$780 per year at this California Defense Supply Agency installation.



August Howard, Jr., warehousing division employee at Defense Depot Tracy, illustrates method he proposed for installing prefabricated reel sides on damaged cable reels. This practice eliminates the need for rewinding material from a damaged reel on a new one. Howard, a warehouse foreman on the swing shift, received a \$110 suggestion award for this idea which is expected to result in savings of more than \$2,150 a year at Defense Depot Tracy, westernmost depot in the Defense Supply Agency distribution system.



About People Here and There—

AF COST REDUCTION MOTIVATOR



Honorable Robert H. Charles, Assistant Secretary of the Air Force (Installations and Logistics), at left, presents a special award to Sherman M. Funk, Chief of the Air Force Cost Reduction Office, for outstanding performance as a primary motivator behind the Air Force Cost Reduction Program.

CADET TURN-INS SPARK REUSE

The U.S. Military Academy no longer spends its money on new field equipment for entering cadets when on-hand, good-as-new equipment fills the bill.

Formerly, each cadet retained for 4 years the complete set of field equipment issued him upon entrance to the Academy even though he had no continuous requirement for this equipment after his first year.

Vincent Tallarico, a supply official at the Academy, determined that most of the equipment stored in company trunkrooms could be turned in for reuse after the student's first year. Now, the cadet keeps only the rifle, dress bayonet, fatigues, khakis, boots, field jacket and socks after the first year. When an upperclassman occasionally requires additional pieces of field equipment, the equipment is reissued to him on a temporary basis.

The new turn-in policy reduced annual procurement costs \$23,140 in fiscal year 1968 and will reduce these costs \$20,920 in fiscal year 1969 and \$20,220 in fiscal year 1970.

NAVY INITIATES MANAGEMENT TRAINING PROGRAM

The Naval Supply Systems Command has initiated a program designed to bring together the diverse and specialized skills of senior supervisory personnel and utilize them in confronting problems and policies of general management.

Called the General Associates Program and composed of civilians of the GS-15 and above level, it will draw upon managerial talent—from what are often specialized areas such as printing, transportation, or purchasing—for participation in conferences, studies, and discussions of top level management issues.

The 32 people in the program are now being oriented to the aims, objectives, policies, and posture of the Supply Systems Command as an entity. The initial presentation was on the budget outlook for 1969 and its potential commandwide impact. The members will in the future attend systems evaluations, problem briefings, special supply conferences, and other functions of general management import.

In addition to bringing talented people into the higher levels of management, in itself beneficial to the Supply Systems Command, the program seeks to increase executive motivation and vary the experience of top level civilian personnel.

CR ADMINISTRATORS RECOGNIZED



Six White Sands Missile Range Employes received certificates for their efforts in the post's cost reduction program. Col. Allen C. Martin, range chief of staff, presented the certificates to (front l. to r.) Mrs. Allison N. Noel, National Range Operations; Mrs. Frances G. Moreno, Procurement Office; and Donald L. Wiggs, Logistics Directorate; (back) Paul C. Cox, WSMR value engineering officer; Jack Scarlett, Management Services; and Samuel Teitelbaum, WSMR comptroller. Mrs. Moreno and Mr. Teitelbaum were cited for savings in the cost reduction area, while the other four employes were recognized for their work as cost reduction officers.

HOODS COVER BOLTS



Joseph Tobia, warehousing division chief at the Defense Personnel Support Center, Philadelphia, was awarded \$529 for suggesting use of protective plastic hoods in lieu of drop cloths in covering textiles at the Center's warehouses.

The Center is a field activity of the Defense Supply Agency. The textile bolts were previously covered with drop cloths which required a forklift and a team of three people to uncover. The plastic hoods are permanent covers, whereas the drop cloths had to be changed and cleaned each year requiring a forklift and a team of three people to uncover the textile bolts.

Tobia's suggestion will result in an estimated first year savings to the Government of \$14,000. He has hit incentive award paydirt 25 other times for a cash total of \$3,000. Photo shows Tobia admiring the results of his most recent idea.

SENECA UPS DEPRIMING PRODUCTIVITY

Richard L. Donselaar increased Seneca Army Depot's productivity 900 percent in processing expended 105-mm. artillery shells for salvage material.

The processing includes removal of screw-type primers. The practice had been to use a modified drill press with an air vice attached to hold the shell casing during the depriming. The hand-operated drilling process was slow and many hours of equipment maintenance were required. Further, these screw-type primers frequently would freeze to the drill—slowing productivity. An average of 100 rounds a day were processed.

Donselaar designed, fabricated, and installed (total cost: \$118) a punchout fixture to remove the primers. His fixture is used on an electrically operated hydraulic press. Production increased to 900 rounds per day, with saving totaling \$37,009.22.

VALUE ENGINEERING COUNCIL FORMS CONSTRUCTION ADVISORY BOARD

Deputy Assistant Secretary of Defense George E. Fouch, Chairman of the DoD Value Engineering (VE) Council, recently announced the establishment of a VE Construction Advisory Board.

The Board, directed by Charles E. Harris, Air Force VE Council representative, is charged with finding ways to apply value engineering to construction projects including site preparation, buildings, paving, utilities installation, equipment and material purchase.

Two representatives from the military departments, and one each from the Defense Supply and Communication Agencies will work with Harris to increase cost savings through more successful VE projects in the entire defense construction field.

RAIL VERSUS TRUCK

Mrs. Loretta Elbert, a traffic management specialist in the production directorate of Defense Contract Administration Services Region, St. Louis (DCASR, St. Louis), received a Cost Reduction Program Achievement Certificate for saving transportation funds.

In processing government bills of lading for the shipment of a total of 312 tank trailers from a contractor's plant in Omaha, Nebr., to various military destinations in Pennsylvania, Ohio, Wisconsin, and Maryland, Mrs. Elbert received freight routings specifying tow-away delivery. This meant that each unit of the shipment would be hauled by a truck-tractor.

Mrs. Elbert, with her extensive knowledge and background in freight rates and routings, questioned this routing. As a result, she was able to obtain a revised routing which allowed a change to rail shipment, permitting the vehicles to move at a cheaper rate. The total savings to the Government amounted to \$51,408.

QUARTET BREAKS CIRCUIT BREAKER COSTS

An unwavering eye toward economy has resulted in a \$908,825 savings for the Defense Electronics Supply Center (DESC) in Dayton, Ohio, and Cost Reduction Employee of the Month awards for four Center civilians.

The Center is a field activity of the Defense Supply Agency.

Cited for achieving the savings on procurement of 889 circuit breakers to be used in Vietnam were: Richard C. Dennis, a contract negotiator; James J. Donovan, a supervisory negotiator; Jack C. Stitts, a commodity branch chief, and David R. Sammons, a value analyst.

The saving produced by the quartet was one of the largest in recent years at DESC.

The manufacturer of the required part quoted \$1,055 a unit to DESC procurement officials.

Sensing the possibility of a savings, Messrs. Dennis, Donovan, and Stitts requested technical assistance from Mr. Sammons to determine if additional procurement sources could be developed and ultimately reduce the price.

Sammons was able to locate additional technical data and fully identify the physical, mechanical, and electrical characteristics of the part.

However, after further analysis, the team determined that the best approach would be to study the application of the item and perhaps provide a different, less complicated circuit breaker instead of attempting to supply an identical substitute. Working with the customer, the DESC quartet was able to gain approval on a \$32.70 circuit breaker, less expensive than the original part but still meeting operational requirements.

The resourcefulness of the DESC employees enabled the Center to procure the 889 circuit breakers for \$29,070 instead of the \$937,895 originally quoted.

AUTOMATED LOCKUP

Company "C," Signal Battalion 360 of the Donnersberg Radio Station (in Germany) recently made an electrical opening lock out of a little scrap material and a lot of knowhow. The lock not only provides a secure gate but also eliminates the need for three locally hired civilian guards, saving the Army \$6,900 annually.

ELIMINATES POCKET

Dominic Pompa has put extra cash in Uncle Sam's pocket, paradoxically, by eliminating a pocket.

Pompa is an industrial specialist at the Defense Personnel Support Center, Philadelphia, Pa., a field activity of the Defense Supply Agency.

Given the job of helping to review the specifications of a tropical combat coat worn by troops in Vietnam, Pompa noted that each of the coat's breast pockets had a built-in pencil pocket. He suggested that the one on the right pocket be eliminated.

The revision was adopted and has reduced the cost of each coat by 7½ cents.

This suggestion has also achieved cost reductions amounting to \$276,877. Officials at the Center expect the idea to yield additional savings of \$229,439 by the end of the current fiscal year.

Pompa became an apprentice tailor at the age of 13. For 20 years he worked in private industry as a custom tailor and also taught tailoring at a night school. During his 24 years of Government service he has been given a special service award and several letters of commendation for his work on various tailoring assignments.

SUBS' TRASH VE'D

Submariners dispose of trash at sea by packing it in cylindrical metal containers and ejecting these containers through a tube equipped with a ball valve. A cap on the loading end of each container cushions the ball valve against the impact of the container. The Navy uses 25,000 such caps each year.

The cap was made of plastic and cost 56 cents until the Navy Ships Parts Control Center, Mechanicsburg, Pa., replaced it with a water resistant, corrugated fiberboard disc costing only 18 cents. Savings total \$9,000 annually.



STUDY REDUCES WRM KIT REQUIREMENT

John Fraley, Jr., and M. Sgt. Kenneth Warrenfeltz, both assigned to Military Airlift Command headquarters at Scott AFB, Ill., saved nearly \$3 million by showing the Air Force how it could reduce requirements for war readiness material kits by relying on materials that support normal peacetime operations.

The two men reviewed the command WRM document, computed MAC aircraft activity at each command location with a wartime mission, compared peacetime and wartime landings to determine locations that required additional material and reviewed the command equipment management file to determine where allocation of WRM could be reduced.

They also determined en route locations where landings had increased or decreased and consolidated tables of allowance and WRM documents into a single document.

Applying the principles developed by Fraley and Warrenfeltz reduced WRM at 29 locations, saving the command \$2,920,000.

RAINY DAY SAVINGS

At Defense Depot Tracy, Calif., Burnham Warner came up with the idea of modifying a watertype fire extinguisher to remove rain water from railroad electric switch battery boxes. Burnham, an employee of the Civil Engineering Division at the California Depot, received a \$25 award for his suggestion, which eliminates the need for removing the battery, wiring, and an 18-inch deep box from the ground. The idea is expected to result in savings of almost \$1,350 during fiscal year 1968 at the Tracy Depot. The depot is a field activity of the Defense Supply Agency. The photo shows Burnham pumping water from a battery box.



TOOL REMOVES CHARGE

Bangor Naval Ammunition Depot, Bremerton, Wash., saved \$360,000 by solving a production line problem in converting Zuni rockets for training purposes.

Bangor's project to convert 55,000 of these rockets into target ammunition ran into difficulties when it appeared that more than 20 percent would have to be disposed of because sealant used in a locking ring made it virtually impossible to remove the explosive charge. Along came Walter McKinney and Harold Neal who

developed a special tool to remove the explosives without taking off the locking ring. A value engineering study, conducted by E. R. Ball of the depot's industrial management department, improved the tool to meet required safety standards.

As a result, the rejection rate of the rockets was reduced to zero, a savings of \$360,000 was realized by the depot, and the suggesters received an award of \$1,415 for their improvement idea.



In the photo (l. to r.) LCDR G. Black, Ordnance Officer; Mr. Harold F. Neal, Jr., Ordnance Worker; Mr. Walter McKinney, Ordnanceman; CAPT E. Ischinger, Jr., Commanding Officer; and Mr. Elbert Ball, Industrial Engineering Supervisor at NAD, Bangor, proudly display a ZUNI rocket, the hardware which was the object of their improvement. Inset shows special tool designed to remove explosive from ZUNI rockets for training.

FLYAWAY AIRLIFT CARGO

John D. Tally, a freight specialist at Atlanta Army Depot, worked out a way to ship 48 light (01A) planes to Southeast Asia at a savings of \$746 per plane. In addition, Mr. Tally's plan shortened delivery time and provided valuable training to the Air National Guard.

Surface delivery of the planes would have been slow. Flying each plane to the port would have been costly and would have added too many hours to the plane engines.

Tally discovered that deliveries could be coordinated with Air National Guard training schedules. The National Guard was flying empty C-124's on training schedules from Atlanta. The 01A planes were therefore dismantled and loaded into the C-124's for air delivery to Dobbins Air Force Base. The planes were then sent by MAC airlift to Southeast Asia.

Savings in packing, crating, and processing amounted to \$1,500 per plane. Savings from "over-the-road" hauling to the Gulf port added another \$246. Offset costs of \$1,000 brought net savings to \$746 per plane, for a total of over \$35,800.

WAX UPSTAGES LACQUER

Fort Gordon, Ga., is saving the Army \$22,000 annually by refinishing damaged furniture with wax instead of lacquer. Colonel Jack Doriot, Director of Maintenance at Fort Gordon, found that unsightly lacquer finish on chairs and tables accounted for 75 percent of the turn-ins for repair.

Items are now stripped, filled, and stained—as before—but not lacquered. Instead, the furniture is returned to the using organization where it is waxed periodically. If the wax finish is scratched, rewaxing repairs the damage without requiring refinishing.



Mr. Chester Mulligon, General Foreman, General Support Branch, left, and Col. Jack V. Doriot, Director of Maintenance, compare waxed tabletop with lacquered one.

USARPAC GETS COST REDUCTION AWARD

The USARPAC (United States Army, Pacific) Command was commended on January 10 by the Department of the Army for being one of the best participants in the Cost Reduction Program for Fiscal Year 1968. USARPAC subordinate commands were credited with saving a total of \$33.5 million, exceeding their assigned goal by almost \$13 million.

Despite the fact that USARPAC is a "troop" command rather than a "logistics" organization, it was able to contribute 10% of the overall Army goal for FY 68.

The biggest reduction in costs came from USARPAC's largest spender—U.S. Army, Vietnam (USARV). The combat command accounted for almost 75% of USARPAC's total figure of \$101.2 million. A single savings in the use of aluminum matting for air strips resulted in \$50.3 million, or almost 50% of the total USARPAC goal. It was found that expensive aluminum matting was not required for all air strips, and the cancellation of the excess matting saved the taxpayer millions of dollars.

Another massive saving was realized when an alert engineer in Vietnam took a look at a bridge spike. A like item already in the Army supply system was found to be similar to the more expensive bridge spikes which the bridge constructors were using in great volume. Substitution of the less expensive item saved \$403 thousand. In another instance, the revision of ordering procedures for fatigues by USARV saved that command \$3.5 million.

In Hawaii, closer to the pocketbooks of Headquarters, USARPAC, a gain was made by the 89th Ordnance Company of U.S. Army, Hawaii (USARHAW) at Fort Shafter. Instead of ordering new equipment that would have corrected a fluctuation in their electrical current, the 89th modified their existing generators and thereby netted a savings of \$18.1 thousand. The Post Engineer of USARHAW improved the efficiency of his maintenance operations and discovered it cost \$12.4 thousand less to operate.

It was a unit in Korea, however, that was cited by the Secretary of the Army for the most significant achievement in the Pacific Theater. The 25th Transportation Center (Movement Control) of the Eighth U.S. Army, determined that its own Army personnel could conduct cargo movement surveys which previously had been done by a private contractor at a cost of \$359.6 thousand per year. The 25th Transportation Center was not only commended for its monetary savings, but also for its interest and devotion to cost reduction principles. The unit recently submitted a substantial savings during the present fiscal year by consolidating cargo movements from depot to user.

LOGISTICS MANAGEMENT IMPROVEMENT

ABOUT three-quarters of the total Defense budget is spent for "logistics" in the broadest sense of that term—i.e., beginning with research and development, and extending through procurement, production, construction of facilities, supply, maintenance, etc., and ending with disposal of surplus materiel and facilities. The cost and effectiveness of our Armed Forces are, therefore, heavily dependent upon the efficiency of our logistics management.

This task, however, can never be considered finally completed. Last year, for example, we made almost 10 million purchases, and our depots processed over 80 million issues to operating units. At least 25 percent of our logistic personnel were new to their jobs, and one out of every 10 items in stock was there for the first time in support of a new weapon system. Thus, no matter how economically and effectively the logistic job was done last year, or last month, or last week, the opportunities for new economies and new improvements are ever present due to the sheer volume and continuous change inherent in the logistics process.

It is for this reason that military logisticians must stay in the forefront of modern business and industrial management practices, and must constantly fashion new tools to manage their complex tasks. During the decade of the 1950's a number of such new tools were fashioned, and these have become a permanent part of the logistics management system, e.g.:

- The Defense Cataloging and Standardization Program.
- The Commodity Single Managers—responsible for

The following is excerpted from former Secretary of Defense Clark M. Clifford's statement on "The 1970 Defense Budget and Defense Program for Fiscal Years 1970-74."



buying, storing, and issuing designated classes of materiel to all Military Departments—plus the Transportation and Communications Single Managers.

- The Armed Services Procurement Regulations—the most comprehensive body of purchasing rules ever devised.
- The initial application of computer technology to the management of Defense inventories.

These and other building blocks were largely in place in January 1961 when President Kennedy, in his first State of the Union Message, called for renewed efforts to assure the efficiency and economy of our operations. It was in response to this request that the Defense Cost Reduction Program was initiated. This program, in seven years, has reported aggregate savings in logistical functions of \$16.5 billion.¹ For the future, the objective of the Cost Reduction Program is to effect new savings at the rate of about \$1 billion annually.

We are happy to report that 87 major Defense contractors have also adopted similar highly disciplined cost reduction programs, under which they, too, are reporting annual savings aggregating about \$1 billion.

Looking towards the future, the question might be asked: How have these improvements been achieved and how can they be sustained? This question can best be answered by reviewing the efforts which have proved most fruitful since 1961 and examining the opportunities for further improvements.

DEFENSE PROCUREMENT—GOAL:

"Buy at the lowest sound price"

Defense contracting has long been the most highly publicized area of Defense logistics. It attracts the most interest, it generates the most review, and it is subjected to the most severe audit. It is estimated that over 3,000 personnel, Government-wide, are devoted to reviewing—frequently after the fact—the procurement actions of Defense contracting officers. This is understandable since more than half of the annual Defense budget is spent on contracts with some 24,000 firms who employ more than 3 million personnel.

The Congress and the public are properly concerned with the question of whether these awards are made impartially and at the lowest sound price. The principal measure of good performance, historically, has been the percentage of each year's contract awards made on the basis of price competitive bids. To carry out President Kennedy's mandate for greater efficiency and economy, specific 5-year achievement goals were established in this area, including (1) Increased contract awards based upon price competition; (2) increased awards to small business firms; and (3) decreased awards un-

der cost-plus-fixed-fee contracts (generally considered the least disciplined in terms of cost control).

Increased Competition

Price competition goals were not only attained but exceeded, prior to the Vietnam buildup. Awards based on price competition increased by one-third between 1961 and 1966, and it was found that for each dollar shifted from noncompetitive to competitive procurement an average price reduction of about 25 percent could be expected. We estimate that price savings of \$2.1 billion were achieved between fiscal year 1962 and fiscal year 1968 as a result of this increased volume of price competition.

Price competitive awards declined in 1967–68² due to the large volume of repeat procurements from established sources, particularly, ammunition, helicopters, and other large consumption items required for the support of our effort in Vietnam. This decline does not mean that the improvements in competitive procurement initiated in 1961–66 have been abandoned, but rather than the "product mix" has changed in such a way as to depress the overall percentage. A key improvement needed in the future is a method of measuring and describing the extent of price competition achieved each year in relation to the *real potential* existing in that year.

Despite the sharp competition for Defense contracts, in an environment which keenly challenges the ingenuity of American industry, some members of the Congress still appear to be of the view that competition exists only when awards are made on the basis of sealed bids obtained under "formal advertisement" procedures. The complexity of most military products is such that "formal advertisement" procedures simply can not be made to work in the vast majority of cases. Today, only the Defense Supply Agency and the General Services Administration deal with items of such simplicity and standardization that formal advertising is widely feasible. Accordingly, we strongly believe that any open transaction which involves adequate competitive participation by qualified firms, with award to the lowest responsible and responsive offerer, should be considered fully competitive. It is the substance, rather than the form, of competition which should be of principal concern to the Congress and the public.

Increased Awards to Small Business

With respect to small business awards, we far exceeded the original goal, which was to increase these awards by at least 10 percent over the 1961 level; i.e.,

² On the basis of the new reporting rules, recommended by GAO and adopted in fiscal year 1968, the following percent of awards were price competitive in each fiscal year: 1961—30.4 percent; 1962—33.0 percent; 1963—33.5 percent; 1964—34.6 percent; 1965—39.0 percent; 1966—40.3 percent; 1967—39.1 percent; 1968—37.0 percent.

¹ The attached table recapitulates the savings achieved since fiscal year 1962 and the goals established for fiscal year 1969.

from 16.3 to 17.9 percent. Such awards reached 21.8 percent in fiscal year 1966, and declined since then to 18.8 percent, as a result of the large procurements of specialized Vietnam items not susceptible to small business participation. As in the case of price competition, a future challenge is to devise a method of realistically portraying the actual results obtained each year in relation to the true potential.

Decreased Cost-Plus-Fixed-Fee Contracts

During fiscal year 1961, CPFF contracts reached 38 percent of total awards, prompting former Secretary of Defense McNamara to issue instructions that incentive type or firm-fixed-price contracts were to be substituted wherever feasible. A 5-year goal of reducing CPFF contracts to 12.3 percent of awards was established. This goal was exceeded when CPFF awards dropped to 9.4 percent in fiscal year 1965. The level has since ranged between 10 and 11 percent. It should be noted, however, that we must avoid the misapplication of fixed-price and incentive type arrangements to research and development projects which involve substantial uncertainties. In this respect, the 10-11 percent level may be too low over the long run.

While it is impossible to ascertain the actual savings which have resulted from tighter forms of contracting, it is estimated that such savings have been well in excess of \$1.1 billion since fiscal year 1962. (These savings are in addition to those resulting from increased price competition.)

* * *

The statistical results described above are, of course, simply an expression of the imaginative and aggressive actions taken by some 64,000 contract and contract administration personnel. Among the innovations which have made these improvements possible are two-step formal advertising, multiyear procurement, spare-parts breakout, direct purchase breakout, contract definition, total package procurement of new weapon systems, contractor performance evaluation, weighted guidelines for profit determination, life cycle costing, formation of the Defense Contract Administration Service and the Defense Contract Audit Agency, and extensive joint training of procurement personnel. More than 8,000 procurement personnel are instructed each year in one or more of the 43 training programs now available.

Looking ahead, the biggest challenges lie in finding (1) new ways of obtaining maximum sound competition; and (2) more effective techniques for formulating the contractual structure covering the development and production of new weapon systems.

These and a host of other issues dictate the need for continuing research into the policies and techniques governing Defense contracting. If we are to obtain the most effective utilization of the Nation's industrial base, more time and talent must be invested in such

management research, perhaps through the establishment of a full-fledged "Procurement Research Laboratory."

INVENTORY MANAGEMENT—GOAL:

"Buy Only What We Need"

This has always been the area of logistics offering the greatest opportunity for waste—and therefore for savings. The reports of the Hoover Commission and the General Accounting Office, and numerous hearings of congressional committees have all spotlighted this potential.

A comprehensive attack on these problems was launched early in calendar year 1961—primarily by accelerating and augmenting the many excellent management improvement programs then in existence. Defense logistics managers can take much pride in the inventory profile as of June 30, 1968, compared with that of June 30, 1961, as shown in the table on the following page:

	June 30, 1961	June 30, 1968	Percent change
Value of major weapons and equipment in use (billions)	\$68	\$100	+47.0
Number of items in catalog (thousands)	3,800	3,969	+4.0
Value of supply system stocks on hand (billions)	\$44.3	\$45.8	+3.0
Stocks required per dollar of major weapons and equipment (cents)	65	45.8	-29.5
Value of excess and long supply (billions)	\$16.5	\$12.7	-23.0
Percent of stocks in excess of requirements (percent)	37	28	-25.0

During the 7 years ending June 30, 1968, cost reduction savings resulting from the above and related improvements totaled \$8.4 billion.

Five principal techniques have characterized the "inventory management revolution" of the 1960's.

Balanced Logistics Guidance

In 1961 the Secretary of Defense began issuing annually a comprehensive statement of the assumptions—as to size of forces, activity levels, and duration of emergencies—which each Military Service should use in computing inventory objectives for equipment, munitions and secondary items. This Logistics Guidance is now issued early each calendar year so that it can be used for computing item requirements and procurement quantities during the budget formulation process.

Such Guidance assures a consistent and balanced approach by all inventory managers. It also helps pre-

vent unnecessary inventory investments, or premature investments, by requiring consideration of (1) utilization of substitute items already on hand; (2) reliance on a warm production base, rather than buying out the inventory objective and closing the base; (3) reexamination of the latest experience in leadtimes, safety factors, and wear out, replacement and consumption rates in computing quantities required; and (4) phasing of deliveries among related items to match the activations of units.

While intensive studies of requirements for major items had been made in prior years, they were not exposed to such detailed evaluation at Chief of Staff, Service Secretary and Secretary of Defense levels. Without question, the additional scrutiny (and challenge) has been a major part of the value of this management technique. Steps are now being taken to expand the annual Guidance to cover facilities and to provide more detail in the secondary item area. Since the Guidance must be reassessed and validated against operational experience, a comprehensive examination of the "lessons learned" in Vietnam should be undertaken, now, as a basis for improving requirements planning practices.

Integrated Supply Management

Several significant organizational changes have been made in this area. These have had a profound affect on the effectiveness and economy of supply support; and they have withstood the critical test of the Vietnam emergency with high credit.

- In late 1961, the Defense Supply Agency (DSA) was formed to buy, store, and issue common items (clothing, medical, fuel, subsistence, general, industrial, construction and electronic supplies). By 1966 DSA was performing these responsibilities with 21 percent less inventory and 13 percent fewer personnel than previously required. Today DSA is managing half of all the items in the Defense inventory.
- The General Services Administration is assuming integrated management of 68,000 items in areas common to many Government agencies, including Defense (primarily office and housekeeping supplies, paint, and hand tools).
- In selected technical areas, individual Military Departments have assumed the integrated management responsibility for all the Services. Today, the Army manages 57,000 common automotive items and the Air Force manages 7,000 common F-4 aircraft parts. This latter technique is being progressively extended to other multiservice aircraft and aircraft engines.
- Coordinated procurement (one Service or DSA buying for all) now covers 446 separate commodity areas with annual purchases of \$14 billion—a sixfold increase since 1960.

• Intensive management of excess and long supply assets has made one of the most dramatic contributions to lower Defense costs since 1961. New procurement is avoided by reusing excess stocks available anywhere in the Defense Department. This is being accomplished primarily by the central clearing house operated by DSA at the Defense Logistics Services Center (DLSC), Battle Creek, Mich. By matching requirements against available assets—using high-speed computers and communications—DLSC coordinated the reutilization of \$4.5 billion in materiel in the 3-year period that ended on June 30, 1968. Similar mechanized screening of excess stocks has now been established in both the Pacific and European areas.

The above and similar actions have diminished excess inventories and improved the utilization of facilities to the point that we have been able to reduce the number of inventory control points from 44 to 22 and close numerous storage points since 1961—releasing altogether about 96 million square feet of covered storage area.

The foundation for integrated supply management has now been solidly laid. Its future scope should be based on the principle that the integrated manager is responsible for *service and support*, in the same sense as an outside contractor. He must never be made responsible for dictating requirements, or allowed to limit mission performance by a unilateral determination of what is to be stocked. However, our Vietnam experience has demonstrated that DSA—and, in fact, all wholesale supply managers—should have current, worldwide knowledge of asset status and consumption trends for selected high-value and critical items in order to carry out their support role efficiently.

Standardization of Systems and Procedures

Beginning in 1962, it became apparent that to obtain maximum benefits from integrated management and to facilitate interchange of stocks among the Services, we needed one set of forms, records and codes for use in requisitioning, shipping and accounting for supplies within and among the Military Departments. Such standardized systems have now been developed, and these, along with the cataloging system developed in the 1950's, now give inventory managers a "common language" and a ready ability to communicate with each other. Moreover, these systems have been accompanied by a procedure, approved by the JCS, involving uniform priority designators which establish the timing and priority of issues from depots.

Value Engineering

This simple but highly effective technique for more economical management, initiated in 1962, has the objective of eliminating unnecessary features ("gold-

plating") in specifications for Defense equipment. Thousands of ideas contributed by personnel at all levels have produced simplifications in the design and manufacture of hardware with cumulative savings of \$1.4 billion. New ideas are continuing to produce value engineering savings at the rate of \$250-\$300 million annually. Defense contractors are also active in this program. In fiscal year 1968, alone, 985 contractor proposals were approved, with savings to the Defense Department of \$52 million.

Harnessing Computers and High-Speed Communications and Transportation

Faster recordkeeping, communications, and transportation have made it possible, for the first time, to manage worldwide inventories on virtually a daily basis. The Air Force, in fact, is managing its 77,000 high-value reparables through daily recording of worldwide stock status in a central computer at Dayton, Ohio. The Army is maintaining exceptionally high equipment readiness rates (helicopters, tanks, vehicles) in Vietnam by daily telephonic communication of parts shortages and airlift resupply.

Today over 900 computers are assigned to supply management, 3½ times as many as in 1961.

A major breakthrough has been the development of high-speed techniques for communicating logistic data over the Defense long-lines network, known as the Automatic Digital Network (AUTODIN). With this system, it is possible for depots to report transactions to inventory managers at a rate of 600,000 messages per day, compared to only 35,000 under previous procedures.

Since 1965 the rate per ton-mile of jet cargo lift has dropped from 10.5 cents to 7.06 cents, and the rate is projected to reach a level of about 4.5 cents with the advent of the C-5A aircraft. Studies are now being made to establish the break-even points where the use of higher cost airlift is more economical than the maintenance of higher stock levels and longer pipelines.

The full exploitation of these new tools—computers, improved communications and faster transportation—will produce the greatest advances in inventory management during the next decade. This will require a higher degree of joint planning among the Services and DSA, under the sponsorship of the Office of the Secretary of Defense. The lessons learned by each Service in supplying our forces in Southeast Asia need to be fully retrieved and studied, now, so that the best practices can be promptly applied in planning future inventory management systems.

SUPPORTING FACILITIES AND SERVICES—GOAL: "Reduce Operating Costs"

This area of logistics management is concerned with the operation of the physical plant, primarily (1) bases

and installations; (2) overhaul and repair facilities; and (3) transportation and communications services. Since 1961 cost reductions in these and related areas have aggregated \$4.6 billion.

Bases and Installations

In January 1961, President Kennedy called special attention to the need for the "elimination of obsolete bases and installations." The first round of studies in support of this objective was completed by March 30, 1961; in the ensuing years there have been seven additional major studies.

A total of 1,110 separate base realinement actions have been taken since 1961, resulting in the release of 1,849,000 acres of land, the excessing of 66 Government-owned industrial facilities, the elimination of 217,602 personnel positions, and the realization of estimated annual savings of \$1.7 billion. From the beginning, special efforts have been made to assist both the communities and the employees adversely affected by these actions. The results have been very encouraging. A large number of the communities affected have succeeded in converting a declining military activity into a growing civilian enterprise. Every career employee displaced has been given a new job offer.

Looking ahead, we believe we will face somewhat different facilities problems in the next 10 years. While reductions or closures will be required from time to time because of changes in the composition of the forces, we may also face problems of forced relocation due to community growth and encroachment. In such instances, long-range planning with the communities affected should be undertaken as soon as an emerging problem is identified, so that a plan can be prepared well in advance of an actual move. Pilot studies of emerging problems in the Southern California area are now being started.

With respect to the replacement and modernization of our hardcore installations and industrial facilities, we face a substantial investment program over the next 10 years. More than two-thirds of our existing facilities are 25 years old or older. Because of the higher priority which had to be given to new operational requirements during the past 7 years, existing facilities have received inadequate attention. It is estimated that our total construction backlog today runs into many billions of dollars. Moreover, substantial outlays will be required to modernize Government-owned industrial facilities, especially shipyards and ammunition plants.

It should be noted that the construction of a \$2.8 billion logistical complex in Southeast Asia, largely by civilian contract, represents one of the outstanding logistic achievements of the past decade. The lessons learned from this experience have recently been fully documented and published.

Overhaul and Repair of Equipment

Naval shipyards, aircraft overhaul and repair facilities, and other major maintenance facilities are the largest employers of logistical manpower—both military and civilian. The major facilities of this type employ over 225,000 personnel and perform work with a cost of \$6 billion annually. Cost reduction savings in excess of \$500 million have been reported since 1962 through improved practices, such as: (1) Lengthening the time between overhauls by better inspection and scheduling; (2) increasing labor productivity 15 to 25 percent through the use of engineered performance standards; and (3) improving systems of reporting maintenance costs and productivity.

For the future, in addition to maintaining these efforts, we should continue to search out new opportunities for expanding integrated maintenance support of common-use equipment, and for devising still better measures of maintenance efficiency in order to spotlight the areas with the greatest potential for further economies.

Transportation and Communication Services

The major contributions of high-speed communications and transportation to improved inventory control and lower inventory investments have already been discussed. The operations of these vital support services are now carried out through a group of single managers, each of which has demonstrated the benefits of this organizational approach. The Military Airlift Command (Air Force), the Military Sea Transportation Service (Navy), the Military Traffic Management and Terminal Service (Army), and the Defense Communications Agency have, each in its respective field, been able to operate or obtain the services required at progressively

lower costs. Since 1962 telecommunications management costs have been reduced by \$582 million, and transportation/traffic management costs by \$339 million.

Numerous projects for improvement in transportation are now in process or under consideration. These include: (1) Revising ocean shipping procurement procedures to obtain a contractual commitment covering the commercial sealift augmentation which will be made available during an emergency; (2) establishing a system of cost-based rates for the ocean transportation of peacetime military cargo; (3) eliminating the servicing of uneconomic points in our logistic airlift systems; and (4) further exploitation of containers, which have already cut handling time and costs so sharply in supporting our forces in Vietnam.

The Defense Communications System (DCS), incorporating the long-line communications capabilities of the three Military Departments, has been developed and implemented during the past decade. DCA has eliminated many individual special-purpose communications circuits and integrated many others into larger common-purpose communications trunks.

* * *

The logistics management improvement efforts, highlighted above, have paid sustained dividends, not because they were new or revolutionary, but because they were highly organized around concrete goals in specific areas, because there was frequent measurement and reporting of progress, and because the President, the Secretary of Defense and the Service Secretaries were personally involved in assessing the results. The opportunities which lie ahead fully justify the continuance of such visibility and top-level emphasis.

Attachment



DOD COST REDUCTION PROGRAM

[In millions of dollars]

Area	Savings realized, fiscal year 1962-66	Savings from—				Goals		
		Fiscal year 1967 actions		Fiscal year 1968 actions		Fiscal year 1969 actions		
		Fiscal year 1967	Fiscal year 1967-69	Fiscal year 1968	Fiscal year 1968-70	Fiscal year 1969	Fiscal year 1969-71	
Buying only what we need:								
Major items.....	2,440	136	196	108	265	129	231	
Initial provisioning.....	964	31	61	25	56	27	38	
Secondary items.....	2,151	110	123	162	207	132	161	
Data management.....	48	12	18	10	19	9	14	
Production base facilities.....	71	4	4	.....	.....	.....	.....
Use of excess inventory.....	434	50	63	88	102	62	76	
Value engineering.....	740	339	609	290	579	242	430	
Inventory item reduction.....	165	3	3	.....	.....	.....	.....
Total buying only what we need.....	7,013	685	1,077	683	1,228	601	950	
Buying at lowest sound price:								
Shift to competitive procurement.....	2,037	30	79	66	118	51	103	
Shift to fixed/incentive.....	1,136	.....	.....	.....	.....	.....	.....
Direct purchase breakout.....	25	11	19	11	20	14	26	
Multi/year procurement.....	137	29	63	20	57	64	126	
Total buying at lowest sound price.....	3,335	70	161	97	195	129	255	
Reducing operating costs:								
Base closures and reductions.....	1,735	7	64	3	85	.....	80
General management improvements.....	739	135	360	162	488	144	346	
Telecommunications management.....	557	11	40	14	43	15	34	
Transportation/traffic management.....	174	53	140	112	231	28	59	
Equipment maintenance management.....	323	32	93	97	249	56	122	
Noncombat vehicle management.....	74	2	8	.....	.....	.....	.....
Contract technicians.....	55	4	7	.....	.....	.....	.....
Military housing management.....	53	5	10	5	10	3	6	
Real property management.....	148	14	31	21	48	16	29	
Packing/packaging.....	45	18	37	15	40	12	24	
Total reducing operating costs.....	3,903	281	790	429	1,194	274	700	
Military assistance program:								
Total program.....	14,273	1,052	2,059	1,219	2,634	1,012	1,916	

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